U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

OFFICE OF NUCLEAR REACTOR REGULATION

6.3 EMERGENCY CORE COOLING SYSTEM

REVIEW RESPONSIBILITIES

Primary - Reactor Systems Branch (~~RSB~~ SRXB[1])

Secondary - None

I. AREAS OF REVIEW

The ~~RSB~~ SRXB[2] reviews the information presented in the applicant's safety analysis report (SAR) regarding the emergency core cooling system (ECCS). The major elements of the review are:

1. Design Bases

   a. The design bases for the ECCS are reviewed to assure that they satisfy applicable regulations, including the general design criteria and the ~~amendments to~~requirements of 10 CFR Part 50, §50.46 regarding ECCS acceptance criteria ~~issued by the Commission on December 28, 1973 (Ref. 1)~~.[3]

   b. The design basis for the BWR automatic depressurization systems (ADS) are also reviewed for compliance with TMI Action Plan Items and associated guidance.[4]

2. Design

   The design of the ECCS is reviewed to determine that it is capable of performing all of the functions required by the design bases.

3. Test Program

The preoperational and initial startup test programs for the ECCS are reviewed by the ~~Procedures and Systems Review Branch (PSRB)~~ Quality Assurance and Maintenance Branch (HQMB)[5] to determine if they are sufficient to confirm the performance capability of the ECCS. ~~RSB~~ SRXB[6] reviews the need for special design features to permit the performance of adequate test programs.

4. Technical Specifications

The proposed technical specifications are reviewed to assure that they are adequate in regard to limiting conditions of operation and periodic surveillance testing.

Review Interfaces:[7]

SRXB also performs the following reviews under the SRP sections indicated:[8]

1. As part of its primary review responsibility for SRP Section 3.12 (proposed), the SRXB reviews the design of the ECCS for evolutionary light-water reactor designs to verify, to the extent practical, that low-pressure portions of the ECCS that interface with the RCS will withstand full RCS pressure. If designing the ECCS with an ultimate rupture strength capable of withstanding full RCS pressure is not possible, the reviewer verifies that appropriate compensating measures have been taken in accordance with the review provided in SRP Section 3.12 (proposed).[9]

2. SRXB reviews the ability of the ECCS to mitigate the consequences of a spectrum of loss-of-coolant accidents ~~is reviewed by RSB~~ under SRP Section 15.6.5.[10]

3. SRXB also reviews the capability of the new applicant's BWR ADS systems to support mitigation of severe accidents as part of its review responsibilities for SRP Section 19.2 (proposed).[11]

In addition, the ~~RSB~~ SRXB[12] will coordinate with other branches' evaluations that interface with the overall ECCS review as follows:

1. The Plant Systems Branch (SPLB) performs the following reviews:

   a. The ~~ASB~~ SPLB ~~also~~[13] reviews the effects of pipe breaks outside containment on ECCS. This review includes the effect of pipe whip, jet impingement forces, and environmental conditions created as part of its primary review responsibility for SRP Section 3.6.1.

   b. SPLB, as part of its review responsibility for SRP Section 3.11, will review the acceptability of, and environmental qualification test program for, ECCS equipment. This review includes consideration of the post-accident environmental design and source term considerations described in TMI action plan item II.B.2 of NUREG-0737 (Reference 34).[14]

c. ~~Auxiliary Systems Branch (ASB)~~ The SPLB[15], as part of its primary review responsibility for SRP Sections 9.2.1, 9.2.2, 9.2.5, and 9.2.6, reviews those auxiliary systems essential for ECCS operation (service water system, component cooling system, ultimate heat sink, and condensate storage facility) and assesses the capability of these systems to perform all functions required by the ECCS. The ~~ASB~~ SPLB[16] will supply, on request, evaluations of portions of the power conversion systems (e.g., steam supply lines, steam generators, feedwater systems) which interface with the reactor coolant system in such a way as to influence the course of a loss-of-coolant accident (LOCA) for a particular plant.

d. The SPLB, as part of its primary review responsibility for SRP Section 9.3.1, reviews the capability and design of the pneumatic supply system for those BWR applicants which use a pneumatic supply for the ADS function.[17]

2. Instrumentation and ~~Control Systems~~ Controls Branch (~~ICSB~~ HICB[18]), as part of its primary review responsibility for SRP Section 7.3, reviews the adequacy of ECCS-associated controls and instrumentation with regard to the features of automatic actuation, remote sensing and indication, and remote control.

3. The Containment Systems and Severe Accident Branch (SCSB) performs the following reviews:

a. The SCSB, as part of its review under SRP Section 6.2.2, addresses containment sump ECCS suction screen inlet design and evaluation guidance central to ensuring that containment sumps provide a reliable, long-term recirculation cooling capability and that ECCS pump performance will not be adversely affected by post-LOCA conditions impacting the sumps.[19]

b. The ~~Containment Systems Branch (CSB~~ SCSB~~)~~[20] verifies that portions of the ECCS penetrating the containment barrier are designed with acceptable isolation features to maintain containment integrity for all operating conditions, including accidents, as part of its primary review responsibility for SRP Section 6.2.4.

4. The ~~Power Systems Branch (PSB)~~ Electrical Engineering Branch (EELB)[21] as part of its primary review responsibility for SRP Sections 8.1, 8.2, 8.3.1, and 8.3.2, reviews the adequacy of the power supply for the ECCS. In addition, as part of its primary review responsibility for SRP Section 8.4 (proposed), the EELB reviews the plant's overall capabilities to withstand or cope with, and recover from a Station Blackout (SBO), and coordinates with the review of the ECCS if the system is required to ensure adequate core cooling as required by 10 CFR 50.63 and the guidance of Regulatory Guide 1.155.[22]

5. The Mechanical Engineering Branch (EMEB) performs the following reviews:

a. The ECCS is ~~also~~ reviewed by ~~MEB~~ EMEB[23] to assure that system and components have the proper seismic and quality group classifications. This aspect of the review is performed as part of its primary review responsibility for SRP Sections 3.2.1 and 3.2.2.

b. ~~In addition, t~~The ~~MEB~~ EMEB[24], as part of its primary review responsibility for SRP Section 3.6.2, reviews the criteria used for postulating the effects of pipe breaks both inside and outside containment on ECCS. This review includes criteria used for postulating the effects of pipe whip, jet impingement forces, and any related environmental conditions.

c. The ~~Mechanical Engineering Branch (MEB~~ EMEB[25]~~)~~, as part of its primary review responsibility for SRP Section 3.9.3, reviews the loading combinations (operational, LOCA, ~~and~~ seismic, and thermal stratification loads[26]) and the associated stress limits.

d. The EMEB also reviews adequacy of the inservice testing program for pumps and valves as part of its primary review responsibility for SRP Section 3.9.6. For new applications, the SRXB review should coordinate with EMEB to ensure the ECCS piping and component configurations allow for full flow testing of safety related pumps and check valves and provisions are made to allow for the use of advanced techniques to detect degradation and to monitor system performance.[27]

6. The Civil Engineering and Geosciences Branch (ECGB) performs the following reviews:[28]

a. The ~~Structural and Geotechnical Engineering Branch (SGEB)~~ ECGB[29] reviews the structures housing the ECCS for the proper seismic classification as part of its primary review responsibility for SRP Sections 3.8.1, 3.8.2, and 3.8.3.

b. The ECGB also reviews the applicable inservice inspection requirements in accordance with its review responsibilities for SRP Section 6.6.[30]

7. The Materials and Chemical Engineering Branch (EMCB) performs the following reviews:

a. The ~~Materials Engineering Branch (MTEB~~ EMCB[31]~~)~~, on a generic basis, reviews the thermal shock effect of water injected into the primary coolant system from the ECCS in accordance with the reviews contained in SRP Sections 5.3.2 and 5.3.3.[32]

b. Related to the implementation of NUREG-0737 item II.K.2.15, specific to B&W operating licensees and applicants, the EMCB coordinates its review with SRXB to assure that B&W once-through steam generator tubes are designed with sufficient margin to assure that if the tubes are stressed under slug flow conditions, mechanical integrity will be maintained, as part of the review performed under SRP Section 5.4.2.1.[33]

8. The Quality Assurance and Maintenance Branch (HQMB) performs the following reviews:

a. The ~~Procedures and Systems Review Branch (PSRB)~~ HQMB[34] reviews the proposed preoperational and initial startup test programs to determine that they are consistent with the intent of Regulatory Guides 1.68 and 1.79 as part of its primary review responsibility for SRP Section 14.2.

b. The ~~PSRB also~~HQMB[35] has primary review responsibility, under SRP Section 13.5.1, for Task Action Plan items ~~II.K.1 (C.1.10) of NUREG-0694 (OLs only)~~I.C.2[36] and I.C.6 of NUREG-~~0718~~0737 ~~(CPs only)~~[37] regarding procedures to ensure that system operability status is known.

c. In addition, the review of Quality Assurance is coordinated and performed by HQMB as part of its primary review responsibility for SRP sections 17.1, 17.2, and 17.3.[38]

9. The ~~Radiological Assessment Branch (RAB)~~ Emergency Preparedness and Radiation Protection Branch (PERB)[39] has primary review responsibility for SRP Sections 12.1 through 12.5, including Task Action Plan items II.B.2 of NUREG-~~0694~~0737 and NUREG-0718 which involve radiation and shielding design review ~~to take corrective actions~~ to ensure adequate access to vital areas and protection of safety equipment ~~(CPs and OLs)~~.[40]

10. The review for Technical Specifications is ~~and Quality Assurance are~~ coordinated and performed by the ~~Standardization and Special Projects Branch and Quality Assurance Branch~~ Technical Specifications Branch (TSB) as part of ~~their~~its primary review responsibility for SRP Section~~s~~ 16.0~~ and 17.0, respectively.~~ [41]

For those areas of review identified above as being reviewed as part of the primary review responsibility ~~of~~for other ~~branches~~SRP Sections, the acceptance criteria necessary for the review and their methods of application are contained in the referenced SRP section ~~of the corresponding primary branch~~.[42]

II. ACCEPTANCE CRITERIA

The ~~RSB~~ SRXB[43] acceptance criteria are based on meeting the relevant requirements of the following regulations:

A. General Design Criterion 2 as it relates to the seismic design of structures, systems, and components (SSCs)[44] whose failure could cause an unacceptable reduction in the capability of the ECCS to perform its safety function. ~~Acceptability is based on meeting position C2 of Regulatory Guide 1.29.~~[45]

B. General Design Criterion 4 as related to dynamic effects associated with flow instabilities and loads (e.g., water hammer).

C. General Design Criterion 5 as it relates to ~~structures, systems, and components~~ SSCs[46] important to safety shall not be shared among nuclear power units unless it can be demonstrated that sharing will not impair their ability to perform their safety function.

D. General Design Criterion 17 as it relates to the design of the ECCS having sufficient capacity and capability to assure that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded during anticipated operational occurrences and that the core is cooled during ~~anticipated operational occurrences and~~[47] accident conditions.

E. General Design Criterion 27 as it relates to the system design having the capability to assure that under postulated accident conditions and with appropriate margin for stuck rods, the capability to cool the core is maintained.

F. General Design Criteria 35, 36, and 37 as they relate to the ECCS being designed to provide an abundance of core cooling to transfer heat from the core at a rate so that fuel and clad damage will not interfere with continued effective core cooling, to permit appropriate periodic inspection of important components, and to permit appropriate periodic pressure and functional testing.

G. 10 CFR Part 50, §50.46, in regard to the ECCS being designed so that its cooling performance is in accordance with an acceptable evaluation model; alternatively, an ECCS evaluation model may be developed in conformance with ~~and~~ Appendix K to 10 CFR Part 50. ~~as it relates to the ECCS being designed so that its cooling performance is in accordance with an acceptable evaluation model.~~[48]

H. TMI Action Plan item II.K.3.18 of NUREG-0737, equivalent to 10 CFR 50.34(f)(1)(vii) for applicants subject to 10 CFR 50.34(f), with respect to eliminating the need for manual actuation of the BWR ADS to assure adequate core cooling.[49]

I. TMI Action Plan item II.K.3.21 of NUREG-0737, equivalent to 10 CFR 50.34(f)(1)(viii) for applicants subject to 10 CFR 50.34(f), with respect to studying the design of BWR core spray and low pressure coolant injection systems to ensure that the systems will automatically restart on loss of water level, after having been manually stopped, if an initiation signal is still present.[50]

J. TMI Action Plan item II.K.3.28 of NUREG-0737, equivalent to 10 CFR 50.34(f)(1)(x) for applicants subject to 10 CFR 50.34(f), with respect to BWR ADS-associated equipment and instrumentation being capable of performing their intended functions during and following an accident, while taking no credit for non-safety related equipment or instrumentation, and accounting for normal expected air (or nitrogen) leakage through valves.[51]

K. TMI Action Plan item II.K.3.45 of NUREG-0737, equivalent to 10 CFR 50.34(f)(1)(xi) for applicants subject to 10 CFR 50.34(f), with regard to providing an evaluation of depressurization methods, other than full actuation of the ADS, that would reduce the possibility of exceeding vessel integrity limits during rapid cooldown for BWRs.[52]

L. TMI Action Plan item III.D.1.1 of NUREG-0737, equivalent to 10 CFR 50.34(f)(2)(xxvi) for applicants subject to 10 CFR 50.34(f), with respect to the provisions for a leakage detection and control program to minimize the leakage from those portions of the ECCS outside of the containment that contain or may contain radioactive material following an accident.[53]

Specific acceptance criteria~~, Regulatory Guides, and Task Action Plan items~~[54] that provide information, recommendations, and guidance and in general describe a basis acceptable to the staff that may be used to implement the requirements of the Commission regulations identified above are as follows:

1.[55] In regard to the ECCS acceptance criteria of 10 CFR 50.46 ~~(Ref. 1)~~[56], the five major performance criteria deal with:

a~~1~~. Peak cladding temperature.
b~~2~~. Maximum calculated cladding oxidation.
c~~3~~. Maximum hydrogen generation.
d~~4~~. Coolable core geometry.
e~~5~~. Long-term cooling.

Guidance, procedures and methods that are acceptable for meeting the requirements for a realistic or best-estimate evaluation model for ECCS performance can be found in Regulatory Guide 1.157. Alternatively, Appendix K to 10 CFR Part 50 contains guidance for conservative ECCS evaluation models.[57] These areas are reviewed as a part of the effort associated with the LOCA analysis (SRP Section 15.6.5). However, the impact of various postulated single failures on the operability of the ECCS, ECCS response times, break locations (including ECCS break locations), and break sizes impacting ECCS capabilities are ~~is~~[58] evaluated under this SRP section.

2. The ECCS must meet the requirements of GDC 35 ~~(Ref. 6)~~[59]. The system must have alternate sources of electric power, as required by GDC 17 ~~(Ref. 4)~~[60], and must be able to withstand a single failure. The ECCS should retain its capability to cool the core in the event of a failure of any single active component during the short term immediately following an accident, or a single active or passive failure during the long-term recirculation cooling phase following an accident.

3. The ECCS must be designed to permit periodic inservice inspection of important components, such as spray rings in the reactor pressure vessel, water injection nozzles, piping, pumps, and valves in accordance with the requirements of GDC 36 ~~(Ref. 7)~~[61]. The ECCS must be designed to permit testing of the operability of the system throughout the life of the plant, including the full operational sequence that brings the system into operation, as required by GDC 37 ~~(Ref. 8)~~[62].

4. The combined reactivity control system capability associated with ECCS must meet the requirements of GDC 27 ~~(Ref. 5)~~[63] and should conform to the recommendation of Regulatory Guide 1.47 ~~(Ref. 11)~~[64]. The primary mode of actuation for the ECCS must be automatic, and actuation must be initiated by signals of suitable diversity and

redundance. Provisions should also be made for manual actuation, monitoring, and control of the ECCS from the reactor control room.

5. The design of the ECCS should conform to the recommendations of Regulatory Guide 1.1 ~~(Ref. 9)~~[65].

6. Design features and operating procedures, designed to prevent damaging water hammer due to such mechanisms as voided discharge lines and water entrainment in steam lines shall be provided, in order to meet the requirements of General Design Criterion 4 ~~(Ref. 17)~~[66].

7. The design of those portions of the system which are not safety related, whose failures could have an adverse effect on the ECCS system, must be in accordance with GDC 2 ~~(Ref. 2)~~[67], and acceptance is based on meeting Position C2 of Regulatory Guide 1.29 ~~(Ref. 10)~~[68].

8. Interfaces between the ECCS and component or service water systems must be such that operation of one does not interfere with, and provides proper support (where required) for, the other. In relation to these and other shared systems, e.g., residual heat removal (RHR) and containment heat removal systems, the ECCS must conform to GDC 5 ~~(Ref. 3)~~[69] .

9. The requirements of Task Action Plan Item II.K.3(15) of NUREG-0737 and NUREG-0718, which involves isolation of HPCI and RCIC for BWR plants, ~~the following Task Action Plan items~~ must also be satisfied.~~:~~[70]

10. For evolutionary BWRs, the requirements and guidance regarding ECCS outage times and reports on ECCS unavailability, contained in Task Action Plan Item II.K.3.17, must also be satisfied.[71]

~~1. Task Action Plan Item II.B.8 of NUREG-0718 (Ref. 14) which involves description by the applicants of the degree to which the designs conform to the proposed interim rule on degraded core accidents (CPs and OLs).~~[72]

~~2. Task Action Plan Item III.D.1.1 of NUREG-0694 and NUREG-0718 which involves primary coolant sources outside of containment (CPs and OLs).~~[73]

~~3. Task Action Plan Item II.E.2.1 of NUREG-0737 which involves reliance on ECCS.~~[74]

~~4. Task Action Plan Item II.K.3(10) of NUREG-0737 and NUREG-0718 which involves final recommendations by B&O task force regarding applicant's proposal of use of anticipatory trips only at high power for selected plants.~~[75]

~~5. Task Action Plan Item II.K.3(15) of NUREG-0737 and NUREG-0718 which involves isolation of HPCI and RCIC for BWR plants.~~[76]

6. Task Action Plan Item II.K.3(18) of NUREG-0737 and NUREG-0718 involving ECCS outages for all plants.[77]

7. Task Action Plan Item II.K.3(21) of NUREG-0737 and NUREG-0718 which involves a study evaluating restart of LPCS and LPCI after manual trip for BWR plants.[78]

8. Task Action Plan Item II.K.3(39) of NUREG-0660 which involves evaluation of effects of water slugs in piping caused by HPI and CFT flows in B&W plants.[79]

In addition to the above criteria, the acceptability of the ECCS may be based on the degree of design similarity with previously approved plants.

Technical Rationale:[80]

The technical rationale for application of the above acceptance criteria to the emergency core cooling system is addressed in the following paragraphs:

1. GDC 2 requires that SSCs important to safety be designed to withstand the effects of natural phenomena without the loss of capability to perform their safety functions. The ECCS is relied upon to provide sufficient emergency core cooling flow to protect the integrity of the reactor core during postulated accidents, including the loss-of-coolant accident. Regulatory Guide 1.29 provides guidance for determining which SSCs should be designed to withstand the safe shutdown earthquake (SSE). Position C.2 recommends that SSCs whose continued function is not required but whose failure could reduce the functioning of the ECCS to an unacceptable safety level should be designed and constructed to withstand the SSE. Meeting the requirements of GDC 2, and positions of Regulatory Guide 1.29, enhances plant safety by ensuring the integrity of Seismic Category I portions of the ECCS and thus the capability to provide core cooling following a seismic event.

2. GDC 4 requires that SSCs important to safety be designed to accommodate the effects of and be compatible with the environmental conditions associated with normal operation, maintenance, testing and postulated accident conditions. These conditions include consideration of the dynamic effects of flow instabilities and the loadings caused by water hammer events. The ECCS provides emergency core cooling in the event that normal cooling methods are not available or are insufficient. Compliance with GDC 4 enhances plant safety by providing assurance that dynamic effects of events such as flow instabilities and water hammer will not adversely affect the fundamental integrity and capability of the ECCS systems to provide core cooling in the event of accidents.

3. GDC 5 prohibits the sharing of SSCs among nuclear power units unless it can be shown that such sharing will not significantly impair the ability of the SSCs to perform their safety functions, including, in the event of an accident in one unit, and orderly shutdown and cooldown of the remaining units. The ECCS provides an important safety function in its ability to provide emergency core cooling and shutdown capability following postulated accidents. The ECCS system must be designed such that the ability to perform this and other designated safety-related functions are not compromised for each

unit regardless of equipment failures or other events that may occur in another unit. Meeting the requirements of GDC 5 enhances plant safety by providing assurance that unacceptable effects of equipment failures or other events occurring in one unit of a multi-unit site will not propagate to the unaffected unit(s).

4. GDC 17 requires that an on-site and off-site electric power supply system be provided to permit functioning of SSCs important to safety. As it relates to the ECCS systems, GDC 17 requires that each power supply system have sufficient capacity and capability to ensure that the core can be cooled in the event of an accident, and that the fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded during anticipated operational occurrences (AOOs). The ECCS is dependent upon the availability of electrical power supplied from the Class IE emergency electrical busses. The power supplies for the ECCS must maintain voltages at electrical equipment within the design limits. With voltages below design limits, electric equipment may not have sufficient capacity or capability to reliably perform their intended safety function during a design basis event. Thus, meeting the requirements of GDC 17 enhances plant safety by ensuring that the ECCS capacity and capabilities will be sufficient to ensure that the fuel design limits and reactor coolant pressure boundary integrity are maintained during AOOs and that the core is cooled during accidents.

5. GDC 27 establishes requirements regarding the combined reactivity control system capability. Upon actuation the ECCS in PWRs provides rapid injection of borated water to ensure reactor shutdown and adequate core cooling with appropriate margins for stuck control rods. Injection of borated water provides negative reactivity to reduce reactor power to residual levels and ensures sufficient cooling flow to the core. Requiring compliance with GDC 27 for the ECCS augments the protection for the primary fission product barrier by providing a means to ensure that the core, under postulated accident conditions, can be safely shutdown and will be maintained in a coolable geometry.

6. GDC 35 requires that an emergency core cooling system be provided that is capable of transferring heat from the reactor core, following a loss of reactor coolant, at a rate sufficient to ensure that the core remains in a coolable geometry and that the clad metal-water reaction is limited to negligible amounts. Following a breach in the reactor coolant pressure boundary, reactor coolant is lost at a rate determined by several factors, including break size and RCS pressure. The emergency core cooling systems are relied upon to inject adequate cooling water into the RCS during a LOCA and to circulate the water through the core to provide for core cooling. The ECCS systems must inject cooling water at a rate sufficient to ensure that the calculated changes in core geometry will be such that the core remains amenable to cooling, and that the calculated cladding oxidation and hydrogen generation meet the specified performance criteria. Meeting the requirements of GDC 35 ensures that the ECCS, assuming a single failure, can provide core cooling under accident conditions sufficient to maintain the core in a coolable geometry and to minimize the production of hydrogen due to reaction of water with the fuel cladding.

7. GDC 36 requires that the emergency core cooling systems be designed to allow for periodic inspections of important components to ensure the integrity and capability of the

system. The ECCS system arrangements must be designed such that adequate clearances are available to conduct periodic inspections of important components. Conduct of periodic inspections is necessary to show that important components of the ECCS systems are being maintained within their design basis specifications and that no significant deterioration is occurring in the systems. Meeting the requirements of GDC 36 enhances plant safety by ensuring that important ECCS components can be inspected and will be capable of operating as designed to cool the core under accident conditions.

8. GDC 37 requires that the emergency core cooling systems be designed to allow for comprehensive periodic pressure and functional testing. The ECCS is required to undergo periodic pressure testing to verify the structural and leak-tight integrity of important components. Periodic functional testing of the ECCS verifies that the systems will operate as designed including the full operational sequence necessary to initiate ECCS operation. Periodic functional test programs, such as the ECCS pump and valve testing, are premised upon the establishment of a reference set of parameters (based upon design specifications) and a consistent test method to allow for the detection of significant system degradation. Meeting the requirements of GDC 37 enhances plant safety by ensuring that important ECCS components can be tested and will remain capable of operating as designed to provide core cooling under postulated accident conditions.

9. 10 CFR Part 50, §50.46, requires that the ECCS be designed so that the calculated cooling performance is in accordance with an acceptable evaluation model or alternately a model in conformance with the features of Appendix K. The primary function of the ECCS is to provide emergency core cooling and negative reactivity addition in the event of a LOCA resulting from a break in the primary reactor coolant system. The primary ECCS safety functions are comprehensively modeled and evaluated for breaks up to and including the double-ended severance of a reactor coolant pipe to show that the ECCS will limit the peak clad temperature to below 1204 °C (2200 °F) and ensure that the core will remain in place and substantially intact with its essential heat transfer geometry preserved. Meeting the requirements of 10 CFR Part 50, §50.46, enhances plant safety by ensuring that the ECCS is designed and evaluated in such a way that the calculated core cooling performance after a LOCA conforms to critical criteria necessary to show that the core geometry will remain amenable to cooling and that long-term decay heat removal will be provided.

III. REVIEW PROCEDURES

The procedures below are used during the construction permit (CP) review to assure that the design criteria and bases and the preliminary design as set forth in the preliminary safety analysis report meet the acceptance criteria given in subsection II of this SRP section.

For operating license (OL) reviews, the procedures are utilized to verify that the initial design criteria and bases have been appropriately implemented in the final design as set forth in the final safety analysis report. The OL review also includes the proposed technical specifications to assure that they are adequate in regard to limiting conditions of operation and periodic surveillance testing.

Much of the review described below is generic in nature and is not performed for each plant. That is, the ~~RSB~~ SRXB[81] reviewer compares the ECCS design and parameters to those of previously reviewed plants and then devotes the major portion of the review effort to those areas where the application is not identical to previously reviewed plants. The following steps are taken by the ~~RSB~~ SRXB[82] reviewer to determine that the acceptance criteria of subsection II have been met. These steps should be adapted to CP, ~~or~~ OL, or design certification[83] reviews as appropriate.

1. The relationship of the system under review to other previously approved plants is established. Systems or design features claimed to be identical or equivalent to those of previously approved plants are confirmed to be identical or equivalent.

2. Piping diagrams are reviewed to evaluate the functional reliability of the system in the event of single failures. That is, by referring to piping and instrumentation diagrams, the existence of the redundancy required by the criteria is confirmed.

3. The significant design parameters (e.g., pump net positive suction head, pump head vs. flow, accumulator volume and pressure, water storage volume, system flow rate and pressure, etc.) are examined for each component to confirm that these parameters satisfy operating requirements and the recommendations of Regulatory Guide 1.1 ~~(Ref. 9)~~[84].

4. The piping and instrumentation diagrams are checked in consultation with ~~MEB~~ EMEB[85] to see that essential ECCS components are designated seismic Category I and Safety Class II (the cooling water side of heat exchangers can be Safety Class III).

5. The ECCS design is reviewed to confirm that the system can function in post-accident environments, considering possible mechanical effects, missiles, and the pressure, temperature, moisture, radioactivity, and chemical conditions resulting from LOCA. Protection against valve motor flooding should be confirmed by the ~~RSB~~[86] reviewer. Regarding the effects of pressure, temperature, etc., the ~~RSB~~[87] reviewer should confirm that accident conditions are specified which provide the basis for proof tests for environmental qualification of ECCS components.

6. The criteria, supporting analyses, plant design provisions, and operator actions that will be taken are reviewed to ensure that there will not be unacceptably high concentrations of boric acid in the core region (resulting in precipitation of a solid phase) during the long-term cooling phase following a postulated LOCA.

7. The ECCS design is reviewed to confirm that there are provisions for maintenance of the long-term coolant recirculation and decay heat removal systems, e.g., pump or valve overhaul, in the post-LOCA environment (including consideration of radioactivity).

8. The availability of an adequate source of water for the ECCS is confirmed, and the source volume, location, and susceptibility to failure (e.g., freezing) are evaluated. (~~RSB~~ SRXB[88] will request ~~ASB~~ SPLB[89] review as required.) In PWRs, the piping from the water source to the ECCS safety injection pumps is evaluated for conformance with Branch Technical Position RSB 6-1 ~~(Ref. 13)~~[90].

9. The ECCS flow paths are reviewed to determine the extent to which flow from the ECCS pumps is diverted as a backup feature to other safeguards equipment (e.g., RHR, containment spray). The reviewer should confirm that the remaining portion of the flow provides abundant core cooling, despite the most severe single failure that affects ECCS flow.

10. For a boiling water reactor (BWR), the reactor coolant ADS~~automatic depressurization~~ systems ~~is~~are reviewed utilizing the following additional procedures to verify compliance with the Acceptance Criteria: ~~confirm the capability to satisfy LOCA pressure relief functions, including consideration of a single failure.~~[91]

    a. The ADS systems, including electrical power supplies, are reviewed to verify they have sufficient independence, redundancy, and capability to allow the ADS to function properly assuming a single failure.[92]

    b. The ADS design is reviewed to verify that actuation of the system can be completed automatically and that manual actuation is not required to assure adequate core cooling (see item II.K.3.18 of Reference 34).[93]

    c. Design features and system analysis to verify performance of the ADS under all accident conditions are reviewed. The reviewer should verify the ADS can satisfy performance requirements without taking credit for non-safety-related equipment or instrumentation, and accounting for normal air (or nitrogen) leakage through the valves (see item II.K.3.28 of Reference 34). For those BWR applicants which use a pneumatic supply for the ADS function, the capability and design of the pneumatic supply system is reviewed under SRP Section 9.3.1.[94]

    d. The applicant's evaluation of the ADS with respect to reactor vessel integrity limits is reviewed. If integrity limits could be exceeded during rapid cooldown, the applicant should evaluate alternate depressurization methods, other than full actuation of the ADS system, such as early depressurization with one or two relief valves (see item II.K.3.45 of Reference 34).[95]

11. The design of ECCS injection lines is reviewed to confirm that the isolation provisions at the interface with the reactor coolant system are adequate. The number and type of valves used to form the interface between low pressure portions of the ECCS and the reactor coolant system must provide adequate assurance that the ECCS will not be subjected to a pressure greater than its design pressure. This may be accomplished by any of the following provisions:

    a. One or more check valves in series with a normally closed motor-operated valve. The motor-operated valve is to be opened upon receipt of a safety injection signal once the reactor coolant pressure has decreased below the ECCS design pressure.

    b. Three check valves in series.

c. Two check valves in series, provided that there are design provisions to permit periodic testing of the check valves for leaktightness and the testing is performed at least annually.

12. The reviewer should identify those portions of nonsafety-related systems which could have an adverse effect on ECCS and should ensure that ~~modifications~~design provisions are in place to ~~correct~~prevent[96] these situations.

13. Motor-operated isolation valves in ECCS lines connecting the accumulators to the reactor coolant system in a pressurized water reactor (PWR) are reviewed to ensure that adequate provisions are made against inadvertent isolation.

14. The capacity and settings of relief valves provided for the ECCS to satisfy system overpressure protection requirements are reviewed. In particular, for PWRs, the reviewer confirms that the accumulator relief valves have adequate capacity so that leakage from the reactor coolant system will not jeopardize the integrity of the accumulators.

15. The ECCS is reviewed to evaluate the adequacy of design features that have been provided to prevent damaging water (steam) hammer due to such mechanisms as voided discharge lines, water entrainment in steam lines and steam bubble collapse. For systems with a water supply above the discharge lines, voided lines are prevented by proper vent location and filling and venting procedures. However, for the core spray and low pressure coolant injection systems of BWRs, the low elevation of the suppression pool will result in line voidage because of back leakage through pump discharge check valves and leaking valves in the full flow test line. Proper vent location and filling and venting procedure are still needed. In addition, a special keep-full system with appropriate alarms is needed to supply water to the discharge lines for any system which has a water source below the level of the highest pump discharge lines and at sufficiently high pressure to prevent voiding.

    For the High Pressure Coolant Injection (HPCI) system of BWRs which use~~s~~[97] a steam-driven turbine, typical design features for the steam supply line include: (a) drain pots with testable drain pot level switches, (b) sloped lines, and (c) limitations on opening and closing sequences and seal-ins for manual operation of the isolation valves to prevent introducing water slugs into the line. The turbine exhaust line features include sloped lines and vacuum breakers.

    Guidance for water hammer prevention and mitigation is found in NUREG-0927 (Reference 35).[98]

16. The reviewer confirms that no component or feature of the ECCS in one reactor facility on a multiple plant site is shared with the ECCS in another facility, or that shared features clearly meet the requirements of GDC 5 ~~(Ref. 3)~~[99].

17. The reviewer confirms that within an individual reactor facility, any components shared between the ECCS and other systems (e.g., coolant makeup systems, residual heat

removal systems, containment cooling systems) satisfy engineered safeguard feature design requirements and that the ECCS function of the shared component is not diminished by the sharing.

18. The reviewer confirms that ECCS components located exterior to the reactor containment are housed in a structure which, in the event of leakage from the ECCS, permits venting of releases through iodine filters designed in accordance with Regulatory Guide 1.52.

19. The complete sequence of ECCS operation from accident occurrence through long-term core cooling is examined to see that a minimum of manual action is required and, where manual action is used, a sufficient time (greater than 20 minutes) is available for the operator to respond.

20. The reviewer confirms that long-term cooling capacity is adequate in the event of failure of any single active or passive component of the ECCS. If an intermediate heat transport system, such as the component cooling water system, is used to provide long-term cooling capability, the system must be designed and constructed to an appropriate group classification, must be seismic Category I, and must be capable of sustaining a single active or passive failure without loss of function.

21. The ~~RSB~~ SRXB[100] reviewer consults with the ~~ICSB~~ HICB[101] reviewer to:

    a. Confirm that the power requirements of the ECCS, including the timing of electrical loads, are compatible with the design of onsite emergency power systems, both a-c and d-c.

    b. Confirm that there are sufficient instrumentation and controls available to the reactor operator to provide adequate information in the control room to assist in assessing post-LOCA conditions, including the more significant parameters such as coolant flow, coolant temperature, and containment pressure. If ECCS flow is diverted as a backup to other safeguards systems, the reviewer confirms that instrumentation and controls are available to provide sufficient information in the control room to determine that adequate core cooling is being provided.

    c. Confirm that automatic actuation and remote-manual valve controls are capable of performing the functions required, that suitable interlocks are provided, which do not impair separation of power trains or inhibit the required valve motions, and that instrumentation and controls have sufficient redundancy to satisfy the single failure criterion.

22. Analyses are provided by the applicant in Chapter 15 of the SAR to assess the capability of the ECCS to meet functional requirements. These analyses are reviewed by the ~~RSB~~ SRXB[102], as described in SRP Section 15.6.5, to determine conformance of the ECCS to the acceptance criteria ~~for ECCS~~.[103] However, the following portions of the review of

ECCS response in loss-of-coolant accidents are performed by the ~~RSB~~ SRXB[104] reviewer under this SRP section:

a. The lower limit of break size for which ECCS operation is required is established; i.e., the maximum break size for which normal reactor coolant makeup systems can maintain reactor pressure and coolant level is determined. The capability of the ECCS to actuate and perform at this lower limit of break size is confirmed.

b. The reviewer confirms that the analyses take into account a variety of potential locations for postulated pipe breaks, including ECCS injection lines.

c. The reviewer confirms that the analyses take into account a variety of single active failures. The reviewer should keep in mind that different single failures may be limiting, depending on the particular break location and break size postulated.

d. The ECCS component response times (e.g., for valves, pumps, power supply) are reviewed to confirm that they are within the delay times used in the accident analyses.

e. The ECCS design adequacy for all modes of reactor operation (e.g., full power, low power, hot standby, cold shutdown, partial loop isolation) is confirmed.

23. The proposed plant technical specifications are reviewed to:

a. Confirm the suitability of the limiting conditions of operation, including the proposed time limits and reactor operating restrictions for periods when ECCS equipment is inoperable due to repairs and maintenance. The means of indicating that safety systems have been bypassed or are inoperable should be in accordance with Regulatory Guide 1.47 ~~(Ref. 11)~~[105].

b. Confirm that the limiting conditions ~~of~~for[106] operation ensure that the specified operating parameters (minimum poison concentrations, minimum coolant reserve in storage, etc.) are within the bounds of the analyzed conditions.

c. Verify that the frequency and scope of periodic surveillance testing is adequate.

24. The reviewer verifies that the emergency core cooling systems are designed to allow for comprehensive periodic inservice inspection, pressure and functional testing as indicated below:[107]

a. The reviewer confirms that the design provides the capability for periodically demonstrating that the system will operate properly when an accident signal is received. That is, it should be demonstrated by an applicant that pumps and valves operate on normal and emergency power and that water pressure and flow are as designed when the plant is operating (periodic system surveillance). When the plant is shut down for refueling, the system should be tested for delivery of

coolant to the vessel. The ECCS design should have provisions to permit appropriate periodic inspection of important components and pressure testing.[108]

b. For new applications, the reviewer verifies that the ECCS piping design incorporates provisions to allow for full flow testing (maximum design flow) of pumps and check valves. For those designs where it is not practical to conduct the inservice pump testing at design flow and pressure, full flow testing at maximum design flow with analysis to extrapolate to design pressure is sufficient (References 21 through 24).

c. For new applications, the reviewer verifies that the ECCS design incorporates provisions to allow for testing of ECCS system motor-operated valves under design-basis differential pressure (References 21 through 24).

d. For new applications, when it is not practicable to achieve design basis differential pressure during ECCS valve testing, a qualification test (under design-basis differential pressure) prior to installation and inservice valve tests conducted under the maximum practicable differential pressure is sufficient (References 21 through 24).[109]

25. The ~~RSB~~[110] reviewer contacts his counterpart in ~~PSRB~~ HQMB[111] to discuss any special test requirements and to confirm that the proposed preoperational test program for the ECCS is in conformance with the intent of Regulatory Guide 1.68 ~~(Ref. 12)~~[112].

26. The ~~RSB~~ reviewer[113] evaluates the applicant responses to the following Task Action Plan items:

~~(a) II.B.8 of NUREG-0718 (CPs only)~~[114]

(a~~b~~) III.D.1.1 of NUREG-0737 ~~and NUREG-0718 (CPs and OIs)~~; the reviewer verifies that those portions of the ECCS located outside of containment that contain or may contain radioactive material following an accident are included in a leakage control program. The leakage control program should include periodic leak testing and measures to minimize leakage from the ECCS.[115]

~~(c) II.E.2.1 of NUREG-0660~~ [116]

~~(d) II.K.3(10) of NUREG-0660~~[117]

(b~~e~~) II.K.3(15) of NUREG-0660; the reviewer should verify that BWR applicants' designs for pipe-break detection circuitry will not cause inadvertent system isolation during pressure spikes resulting from HPCI and RCIC system initiation. For those plants utilizing a time delay relay, the minimum expected response time will be plant specific, the maximum response time shall be no greater than seven seconds unless the applicant provides proper justification for using a longer response time (Reference 25).[118]

~~(f) II.K.3(18) of NUREG-0660~~[119]

(c~~g~~) II.K.3.~~(~~21~~)~~ of NUREG-~~0660~~0737; the reviewer should verify that BWR applicants have studied the design of BWR core spray and low pressure coolant injection systems to ensure that the systems will automatically restart on loss of water level, after having been manually stopped, if an initiation signal is still present.[120]

~~(h) II.K.3(39) of NUREG-0660~~[121]

27. For evolutionary BWRs, the reviewer verifies that the applicant has administrative procedures in place that establish limitations on the ECCS cumulative outage times. The reviewer verifies that the applicant will prepare and submit annual reports on ECCS unavailability that also include information on: outage dates, lengths, and causes; ECCS components involved; and any corrective action taken (Reference 34).[122]

28. The reviewer verifies that the applicant has considered the following guidance regarding the design of the ECCS miniflow systems necessary to insure safety related ECCS pump protection:

    a. Insure that the minimum cooling flow provided for the ECCS pumps is adequate under all conditions, including verification that the system configuration precludes pump-to-pump interaction during miniflow operation that could result in dead-heading one or more of the pumps. The miniflow must be sufficient to prevent damage to the pump(s) under all conditions (References 28, 29 and 31).

    b. The miniflow system shall be designed such that the miniflow function can be performed assuming a single failure. A single failure should not result in conditions causing no flow through the ECCS pumps (Reference 30).

    c. In cases where only the miniflow return line is available for pump testing, flow instrumentation must be installed on the miniflow return line. This instrumentation is necessary to provide flow rate measurements during pump testing so that this data can be evaluated with the measured pump differential pressure to monitor for pump hydraulic degradation (References 27 and 31).[123]

29. The reviewer evaluates the ECCS capability to provide reactor coolant system inventory additions during reduced inventory operations as follows (Reference 26):

    a. PWR designs and related operating procedures should have a means of providing at least two available or operable means of adding inventory to the RCS that are in addition to pumps that are a part of the normal decay heat removal systems. These means should include at least one high pressure injection pump from the ECCS.

    b. The water addition rate provided by each of the means should be at least sufficient to keep the core covered.

c. Procedures should be provided for use of these systems during loss of decay heat removal events. The path of water addition must be specified to assure the flow does not bypass the reactor vessel before exiting any opening in the RCS.[124]

30. The reviewer coordinates with EMEB and verifies that the applicant has reviewed their ECCS design configurations to identify any unisolable piping connected to the RCS that could be subjected to temperature distributions which would result in unacceptable thermal stresses. This review should consider the potential for thermal stratification, thermal cycling and thermal fatigue given the ECCS piping configurations. The reviewer verifies that appropriate action has been taken, where such piping is identified, to ensure that the piping will not be subjected to unacceptable thermal stresses (Reference 32). The SRXB review focuses on ECCS configurations; reviewing the stress analysis and ensuring the stresses are in compliance with the ASME code is the responsibility of EMEB in SRP Section 3.9.3.[125]

For standard design certification reviews under 10 CFR Part 52, the procedures above should be followed, as modified by the procedures in SRP Section 14.3 (proposed), to verify that the design set forth in the standard safety analysis report, including inspections, tests, analysis, and acceptance criteria (ITAAC), site interface requirements and combined license action items, meet the acceptance criteria given in subsection II. SRP Section 14.3 (proposed) contains procedures for the review of certified design material (CDM) for the standard design, including the site parameters, interface criteria, and ITAAC.[126]

IV. EVALUATION FINDINGS

The reviewer verifies that the SAR contains sufficient information and ~~his~~that the[127] review supports the following kinds of statements and conclusions which should be included in the staff's safety evaluation report. (For completeness, this evaluation finding includes the ~~RSB~~ SRXB[128] review effort described in SRP Section 15.6.5.)

The emergency core cooling system (ECCS) includes the piping, valves, pumps, heat exchangers, instrumentation, and controls used to transfer heat from the core following a loss-of-coolant accident. The scope of review of the ECCS for the _____ plant included piping and instrumentation diagrams, equipment layout drawings, failure modes and effects analyses, and design specifications for essential components. The review has included the applicant's proposed design criteria and design bases for the ECCS and the manner in which the design conforms to these criteria and bases.

The staff concludes that the design of the Emergency Core Cooling System is acceptable and meets the requirements of General Design Criteria 2, 4, 5, 17, 27, 35, 36, and 37; 10 CFR 50.34(f)(1)(vii)[129], (viii)[130], (x)[131], and (xi)[132]; 10 CFR 50.34(f)(2)(xxvi)[133]and 10 CFR 50.46[134] This conclusion is based on the following:

(1) The applicant has met the requirements of GDC 2 with regard to the seismic design of nonsafety systems or portions thereof which could have an adverse effect on ECCS by meeting position C.2 of Regulatory Guide 1.29.

(2) The applicant has met the requirements of GDC 4 as related to dynamic effects associated with flow instabilities and loads (e.g., water hammer).

(3) The applicant has met the requirements of GDC 5 with respect to sharing of structures, systems, and components (SSCs)[135] by demonstrating that such sharing does not significantly impair the ability of the ECCS to perform its safety function including, in the event of an accident to one unit, an orderly shutdown and cooldown of the remaining units.

(4) The applicant has met the requirements of GDC 17 with regard to providing sufficient capacity and capability to assure that (a) specified acceptable fuel design limits and design conditions of the reactor coolant pressure boundary are not exceeded as a result of anticipated operational occurrences and (b) the core is cooled and vital functions are maintained in the event of postulated accidents.

(5) The applicant has met the requirements of GDC 27 with regard to providing combined reactivity control system capability to assure that under postulated accident conditions and with appropriate margin for stuck rods the capability to cool the core is maintained and the applicant's design meets the guidelines of Regulatory Guide 1.47.

(6) The applicant has met the requirements of GDC 35 to provide abundant cooling for ECCS by providing redundant safety-grade systems that meet the recommendations of Regulatory Guide 1.1.

(7) The applicant has met the requirements of GDC 36 with respect to the design of ECCS to permit appropriate periodic inspection of important components of the system.

(8) The applicant has met the requirements of GDC 37 with respect to designing the ECCS to permit testing of the operability of the system throughout the life of the plant, including the full operational sequence that brings the system into operation.

(9) The applicant has provided an analysis of the proposed ECCS relative to the acceptance criteria of 10 CFR Part 50, §50.46, and with regard to the evaluation models the guidance of Regulatory Guide 1.157 or alternatively Appendix K of 10 CFR Part 50. ~~to~~The applicant has demonstrated that their ECCS designs satisfy the criteria for peak cladding temperature, maximum calculated cladding oxidation, maximum hydrogen generation, coolable core geometry, and long-term cooling ~~are~~ in accordance with ~~the~~an acceptable evaluation model.[136]

(10) The applicant has met II.K.3.18 of NUREG-0737, equivalent to 10 CFR 50.34(f)(1)(vii) for applicants subject to 10 CFR 50.34(f), with respect to eliminating the need for manual actuation of the BWR ADS to assure adequate core cooling.[137]

(11) The applicant has met II.K.3.21 of NUREG-0737, equivalent to 10 CFR 50.34(f)(1)(viii) for applicants subject to 10 CFR 50.34(f), with respect to reviewing the design of BWR core spray and low pressure coolant injection systems to ensure that the systems will automatically restart on loss of water level, after having been manually stopped, if an initiation signal is still present.[138]

(12) The applicant has met II.K.3.28 of NUREG-0737, equivalent to 10 CFR 50.34(f)(1)(x) for applicants subject to 10 CFR 50.34(f), with respect to the BWR ADS-associated equipment and instrumentation being capable of performing their intended functions during and following an accident, while taking no credit for non-safety related equipment or instrumentation, and accounting for normal expected air (or nitrogen) leakage through valves.[139]

(13) The applicant has met II.K.3.45 of NUREG-0737, equivalent to 10 CFR 50.34(f)(1)(xi) for applicants subject to 10 CFR 50.34(f), in regard to an evaluation of depressurization methods, other than full actuation of the ADS, that would reduce the possibility of exceeding vessel integrity limits during rapid cooldown for BWRs.[140]

(14) The applicant has met III.D.1.1 of NUREG-0737, equivalent to 10 CFR 50.34(f)(2)(xxvi) for applicants subject to 10 CFR 50.34(f), with respect leakage detection and control in the design of ECCS outside containment that contain (or may contain) radioactive material following an accident.[141]

In addition, the applicant has met the requirements of Task Action Plan item II.K.3(15) of NUREG-0660 which involves isolation of HPCI and RCIC for BWR plants. ~~the following Task Action Plan items:~~[142]

~~(1) Meeting Task Action Plan item II.B.8 of NUREG-0718 (Ref. 14) which involves description by the applicants of the degree to which the designs conform to the proposed interim rule on degraded core accidents (CPs only).~~[143]

~~(2) Meeting Task Action Plan item II.D.1.1 of NUREG-0737 (Ref. 15) and NUREG-0718 (Ref. 14) which involves primary coolant sources outside of containment (CPs and OLs).~~[144]

~~(3) Meeting Task Action Plan item II.E.2.1 of NUREG-0660 (Ref. 16) which involves reliance on ECCS.~~[145]

~~(4) Meeting Task Action Plan item II.K.3(10) of NUREG-0660 which involves applicant's proposal to limit anticipatory trip to high power for selected plants.~~[146]

~~(5) Meeting Task Action Plan item II.K.3(15) of NUREG-0660 which involves isolation of HPCI and RCIC for BWR plants.~~[147]

~~(6) Meeting Task Action Plan item II.K.3(18) of NUREG-0660 which involves ECCS outages for all plants.~~[148]

~~(7) Meeting Task Action Plan item II.K.3(21) of NUREG-0660 which involves restart of LPCS and LPCI for BWR plants.~~[149]

~~(8) Meeting Task Action Plan item II.K.3(3a) of NUREG-0660 which involves evaluation of effects of water slugs in piping caused by HPI and CFT flows in B&W plants.~~[150]

For design certification reviews, the findings will also summarize, to the extent that the review is not discussed in other safety evaluation report sections, the staff's evaluation of inspections, tests, analyses, and acceptance criteria (ITAAC), including design acceptance criteria (DAC), site interface requirements, and combined license action items that are relevant to this SRP section.[151]

V. IMPLEMENTATION

The following is intended to provide guidance to applicants and licensees regarding the NRC staff's plans for using this SRP section.

This SRP section will be used by the staff when performing safety evaluations of license applications submitted by applicants pursuant to 10 CFR 50 or 10 CFR 52.[152] Except in those cases in which the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method described herein will be used by the staff in its evaluation of conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications docketed six months or more after the date of issuance of this SRP section.[153]

Implementation schedules for conformance to parts of the method discussed herein are contained in the referenced regulations, regulatory guides, NUREGs, and BTP RSB 6-1.[154] ~~and~~ ~~i~~Implementation of acceptance criterion subsection II.B is as follows:

(a) ~~Operating plants and OL applicants need not comply with the provisions of this revision.~~Plants with an operating license issued prior to April 1984 and operating license applications docketed prior to April 1984 need not comply with the provisions of this item but may do so voluntarily.[155]

(b) ~~CP applicants will be required to comply with the provisions of this revision.~~Applicants for a construction permit as of April 1984 will be required to comply with the provisions of this item.[156]

(c) Applications docketed on or after April 1984 will be reviewed according to the provisions of this item.[157]

VI. REFERENCES[158]

1. 10 CFR Part 50, § 50.34(f), "Additional TMI-Related Requirements."[159]

21. 10 CFR Part 50, §50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water-Cooled Nuclear Power Reactors,." and Appendix K to 10 CFR Part 50, "ECCS Evaluation Models." issued by the Commission December 28, 1973; Federal Register, Vol. 39, No. 3, January 4, 1974[160]

3. 10 CFR 50, §50.63, "Loss of all Alternating Current Power."[161]

42. 10 CFR Part 50, Appendix A, General Design Criterion 2, "Design Bases for Protection Against Natural Phenomena."

517. 10 CFR Part 50, Appendix A, General Design Criterion 4, "Environmental and Dynamic Effects Design Basis."[162]

63. 10 CFR Part 50, Appendix A, General Design Criterion 5, "Sharing of Structures, Systems, and Components."

74. 10 CFR Part 50, Appendix A, General Design Criterion 17, "Electric Power Systems."

85. 10 CFR Part 50, Appendix A, General Design Criterion 27, "Combined Reactivity Control System Capability."

96. 10 CFR Part 50, Appendix A, General Design Criterion 35, "Emergency Core Cooling."

107. 10 CFR Part 50, Appendix A, General Design Criterion 36, "Inspection of Emergency Core Cooling System."

118. 10 CFR Part 50, Appendix A, General Design Criterion 37, "Testing of Emergency Core Cooling System."

12. 10 CFR Part 50, Appendix K , "ECCS Evaluation Models."[163]

139. Regulatory Guide 1.1, "Net Position Suction Head for Emergency Core Cooling and Containment Heat Removal System Pumps."

1410. Regulatory Guide 1.29, "Seismic Design Classification," Revision 1.[164]

151. Regulatory Guide 1.47, "Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems."[165]

162. Regulatory Guide 1.52, "Design, Testing, and Maintenance Criteria for Postaccident Engineered-Safety-Feature Atmosphere Atmospheric Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants."[166]

173. Regulatory Guide 1.68, "Preoperational and Initial Startup Test Programs for Water-Cooled Nuclear Power Plants Reactors."[167]

18. Regulatory Guide 1.155, "Station Blackout."[168]

19. Regulatory Guide 1.157, "Best-Estimate Calculations of Emergency Core Cooling System Performance."[169]

20~~14~~. Branch Technical Position RSB 6-1, "Piping From the RWST (or BWST) and Containment Sump(s) to the Safety Injection Pumps," attached to this SRP Section ~~6.3~~.[170]

21. SECY 90-016, "Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationship to Current Regulatory Requirements," dated January 12, 1990.[171]

22. Staff Requirements Memorandum, "SECY 90-016 - Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationships to Current Regulatory Requirements," dated June 26, 1990.[172]

23. SECY 93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," dated April 2, 1993.[173]

24. Staff Requirements Memorandum, "SECY 93-087 - Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs," dated July 21, 1993.[174]

25. NRC Letter to all Boiling Water Reactor Licensees, "NUREG-0737 Technical Specifications (Generic Letter No. 83-02)," January 10, 1983.[175]

26. NRC Letter to all Holders of Operating Licenses or Construction Permits for Pressurized Water Reactors (PWRs), "Loss of Decay Heat Removal (Generic Letter No. 88-17)," October 17, 1988.[176]

27. NRC Letter to All Holders of Light Water Reactor Operating Licenses and Construction Permits, "Guidance on Developing Acceptable Inservice Testing Programs (Generic Letter 89-04)," April 3, 1989.[177]

28. NRC Bulletin 79-24, "Frozen Lines," September 27, 1979.[178]

29. NRC Bulletin 80-18, "Maintenance of Adequate Minimum Flow Thru Centrifugal Charging Pumps Following Secondary Side High Energy Line Rupture," July 24, 1980.[179]

30. NRC Bulletin 86-03, "Potential Failure of Multiple ECCS Pumps Due to Single Failure of Air-Operated Valve in Minimum Flow Recirculation Line," October 8, 1986.[180]

31. NRC Bulletin 88-04, "Potential Safety-Related Pump Loss," May 5, 1988.[181]

32. NRC Bulletin 88-08, "Thermal Stresses in Piping Connected to Reactor Coolant Systems," June 22, 1988 and its Supplements 1 through 3.[182]

33~~15~~. NUREG-0718, "Licensing Requirements for Pending Applications for Construction Permits and Manufacturing Licenses."

34~~16~~. NUREG-0737, "Clarification of TMI Action Plan Requirements."

35. NUREG-0927, Revision 1, "Evaluation of Water Hammer Occurrences in Nuclear Power Plants," March 1984.[183]

36. American National Standard, "Single Failure Criteria for PWR Fluid Systems," ANSI N658 (ANS 51.7).[184]

BRANCH TECHNICAL POSITION RSB 6-1
CURRENTLY THE RESPONSIBILITY OF THE REACTOR SYSTEMS BRANCH (SRXB)[185]
PIPING FROM THE RWST (OR BWST) AND CONTAINMENT SUMP(S)
TO THE SAFETY INJECTION PUMPS

A. Background

Current PWRs utilize the refueling water storage tank (RWST) or the borated water storage tank (BWST) as the sole source of water for the safety injection pumps during the first 20 to 40 minutes of any accident that trips a safety injection signal. Since acceptable results of safety analyses of the accidents are based on the operation of a minimum number of these pumps interruption of this water supply for even a short period of time could result in unacceptably high fuel and cladding temperatures if the safety injection pumps fail because of cavitation or overheating.

General Design Criteria 35 requires that the emergency core cooling system have suitable redundancy in components and features and suitable interconnections to assure the system safety function can be accomplished assuming a single failure. The principal problem appears to be a definition of single failure. ~~A recent draft of~~ ANSI N658, "Single Failure Criteria for PWR Fluid Systems," (Reference 36) defines an active failure as:

(a) "An active failure is a malfunction, exceluding passive failures, of a component which relies on mechanical movement to complete its intended function upon demand."

(b) "Spurious action of a powered component originating within its actuation or control[186] system shall be regarded as an active failure unless specific design features or operating restrictions preclude such spurious action."

This branch position on the availability of the RWST is based on the above criteria and the recognition that water supplied from the RWST system to the ECCS system is absolutely essential in the event of a LOCA.

B. Branch Position

1. The single active failure criterion defined in (a) and (b) above will be applied in evaluating the design of the piping systems that connect the safety injection pumps to the RWST (BWST) and the containment sumps.

2. The piping systems, including valves, shall be designed to satisfy the requirements listed below without the need to disconnect the power to any valve.

3. The valves and piping between the RWST (or BWST) and the safety injection pumps must be arranged so that no single failure will prevent the minimum flow to the core required to satisfy 10 CFR Part 50, §50.46.

4. The valves and piping between the RWST (or BWST) and safety injection pumps must be arranged so that no single active failure will result in damage to pumps

such that the minimum flow requirements for long-term core and containment cooling after a LOCA are not satisfied.

5. The valves and piping that connect the RWST (or BWST) and the containment sumps(s)[187] to the safety injection pumps must be arranged so as not to preclude automatic switchover from the injection mode of ECCS operation to recirculation cooling from the sump. These piping systems must be arranged so that the differential pressure between the sump and the RWST (or BWST), even if there is a single active failure, will not result in a loss of core cooling or a path that permits release of radioactive material from the containment to the environment.

C. Implementation[188]

1. Applicants for a construction permit for which an SER was published prior to April 16, 1975 will not be required to comply with the provisions of this item.[189]

2. For plants with an operating license issued prior to July 1981 and operating license applications docketed prior to July 1981 the position will not be completely applied. Specifically, locking out power to valves will be permitted. For most plants it is expected that this will be sufficient to meet the single failure criteria. However, in other plants changes to the piping and valving arrangements may be required to satisfy the single failure criteria.[190]

3. Applications docketed on or after July 1981 will be reviewed according to the provisions of this item.[191]

~~1. CPs Under Review and Future CP Reviews~~

~~The proposed position will be applied to all CP reviews for which an SER was not published prior to April 16, 1975. It is expected that all of the events of the proposed position will be applied for such reviews. Taking this position on CPs would eliminate the need for various schemes such as locking out power to valves located in the line between the various ECCS pumps and refueling water storage tank.~~

~~2. OLs Under Review~~

~~For operating licenses that are presently under review and OLs to be reviewed in the future that are not covered by item 1, the proposed position will not be completely applied. Specifically, locking out power to valves will be permitted. For most plants it is expected that this will be sufficient to meet the single failure criteria. However, in other plants changes to the piping and valving arrangements may be required to satisfy the single failure criteria.~~

~~3. Plants Under Construction~~

These plants will be handled as discussed in item C.2. It is expected, however, that we will discuss the proposed position with each of the applicable PWR vendors. It will be obvious to the vendors which plants now under construction may have a problem. Then a generic review may be conducted for those plants that have a severe problem.

4. Operating Plants

All of the operating plants are being evaluated as an ongoing part of the current ECC review. The review should be conducted as discussed in item C.2 to assure that these plants meet the essential parts of the proposed position.

SRP Draft Section 6.3
Attachment A - Proposed Changes in Order of Occurrence

Item numbers in the following table correspond to superscript numbers in the redline/strikeout copy of the draft SRP section.

Item	Source	Description
1.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP section.
2.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP section.
3.	**Integrated Impact # 600**; Reformat Reference Citations	In accordance with the more recent amendments to 10 CFR 50.46, this area of review has been revised to delete the reference to the old amendment date and to clearly define the associated sections of 10 CFR Part 50.
4.	**Integrated Impact # 595, 596, 597.**	Added an Area of Review discussion on the scope and coordination of the ADS systems for BWRs. The ADS systems on BWRs are an integral part of the ECCS, therefore, the associated requirements, staff positions and guidance applicable to the ADS will be reviewed in this SRP Section.
5.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP section 14.2.
6.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP section.
7.	SRP-UPD format item, Reformat Areas of Review.	Added "Review Interfaces" heading to Areas of Review. Reformatted existing description of review interfaces into a numbered paragraph format to describe how SRXB reviews aspects of the ECCS under other SRP sections and how other branches support the review.
8.	SRP-UDP Format Item, Reformat Areas of Review.	Added an introductory sentence for those areas of review performed by the SRXB in other SRP sections.
9.	**Integrated Impact # 604**	Added an Areas of Review to address the reviews regarding interfacing systems LOCA to be contained in proposed new SRP Section 3.12. The review in accordance with the proposed new SRP Section will be conducted by the SRXB.
10.	**Integrated Impact # 600** and SRP-UDP Format Item	In order to accommodate the changes to the Review Interfaces required by the SRP-UDP format this sentence was modified to reflect the current PRB assignment for SRP section 15.6.5. This sentence was also moved so it is included under the review interfaces for SRXB.
11.	**Integrated Impact # 595**	Added a review interface to address the SRXB reviews of proposed SRP Section 19.2 regarding the BWR ADS system capability to support mitigation of severe accidents for new plant applicants.

Item	Source	Description
12.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP section 6.3.
13.	SRP-UDP Format Item, Update PRB names and Editorial.	Changed PRB name to reflect latest responsibility assignments for SRP section 3.6.1 and deleted the use of "also" since this is now the first interface listed for this branch.
14.	**Integrated Impact # 1105**	Added a review interface to SRP section 3.11 to address environmental qualification of ECCS equipment important to safety for post-accident source term exposure. This Review Interface includes consideration of the post-accident environmental design and source term considerations described in TMI action plan item II.B.2 of NUREG-0737.
15.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 9.2.1, 9.2.2, 9.2.5, and 9.2.6.
16.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 9.2.1, 9.2.2, 9.2.5, and 9.2.6.
17.	**Integrated Impact # 597.**	Added a review interface to address the capability and design of the pneumatic supply system for those BWRs that use pneumatic supply for the ADS function. This is consistent with the reviews performed in the FSER for the ABWR.
18.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP section 7.3.
19.	Disposition of Potential Impacts 99, 1269, 8025, 25608 and 25609	Added an Area of Review (review interface) to address the coordination and review of any ECCS suction intakes in the containment sumps under SRP Section 6.2.2.
20.	SRP-UDP Format Item, Update PRB names.	Deleted full PRB name and replaced with its acronym as it is already defined above. Changed PRB name to reflect latest responsibility assignments for SRP section 6.2.4.
21.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 8.1, 8.2, 8.3.1, and 8.3.2.
22.	**Integrated Impact # 605.**	Revised Areas of Review (review interfaces) to indicate that the overall review of compliance with 10 CFR 50.63, the station blackout rule, and the guidance of Regulatory Guide 1.155, is reviewed primarily in SRP Section 8.3.1.

Item	Source	Description
23.	SRP-UDP Format Item, Update PRB names and Editorial.	Changed PRB name to reflect latest responsibility assignments for SRP sections 3.2.1 and 3.2.2 and removed "also."
24.	SRP-UDP Format Item, Update PRB names and Editorial.	Changed PRB name to reflect latest responsibility assignments for SRP section 3.6.2 and removed the phrase "In addition".
25.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP section 3.9.3.
26.	**Integrated Impact # 601**	Added an item on thermal stratification loads as part of the Area of Review (review interface) to SRP section 3.9.3. Thermal stratification and the resultant thermal stress are reviewed by the EMEB under SRP section 3.9.3.
27.	**Integrated Impact # 602**	Added a new review interface to expand upon and clarify the staff positions and guidance for evolutionary plants regarding additional inservice testing provisions that must be considered for safety-related pumps and valves.
28.	Editorial	Consistent with other PRB interfaces involving multiple sections, a lead-in sentence and alpha-numeric paragraph identification was added for ECGB reviews to accommodate the addition of SRP Section 6.6.
29.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 3.8.1, 3.8.2, and 3.8.3.
30.	**Integrated Impact # 602**	Added a review interface to SRP Section 6.6 to address the review of inservice inspection requirements.
31.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for the review of thermal shock effects. The full PRB name was stricken as the new PRB name is addressed above.
32.	Disposition of Potential Impact 76	Added references to SRP Sections 5.3.2 and 5.3.3 to address the consistency check for potential impact 76. The pressurized thermal shock issues are addressed by EMCB under SRP Sections 5.3.2 and 5.3.3.

Item	Source	Description
33.	**Integrated Impact # 1122**	Added an Areas of Review (review interface) discussion addressing the specifics of II.K.2.15. This TMI Action Plan item is specific to B&W reactors with once-through steam generator designs. The concern was that the tubes could withstand the stresses that could result from slug flow conditions. The EMCB is responsible for ensuring that the steam generator tubes are designed with sufficient margin to assure that when stressed under operating, maintenance, testing and postulated accident conditions, the mechanical integrity of the tubes will not be compromised. This Area of Review addresses the coordination necessary to ensure that the specific B&W design will be comprehensively reviewed to ensure the stresses resulting from slug flow conditions are addressed.
34.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP section 14.2.
35.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments regarding procedures to ensure that system operability status is known.
36.	**Integrated Impact # 1107,** Editorial.	Deleted the reference to II.K.1(C.1.10) in the Areas of Review (review interfaces) and replaced the reference with one combined reference to TMI action plan items I.C.2 and I.C.6. Identified SRP Sections under which these TMI items are reviewed by HQMB. This is a review interface only, there are no other references to these TMI Action Plan items in the Acceptance Criteria or the Review Procedures.
37.	**Integrated Impact # 1034**	The reference to NUREG-0718 was changed to NUREG-0737 and "(CP) only" was deleted. Contrary to the citation in SRP section 6.3 this item was clarified in NUREG-0737. NUREG-0718 does not indicate that this is a TMI action plan item to be addressed in an application for a construction permit.
38.	SRP-UDP Format Item, Editorial and Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP sections 17.1, 17.2 and 17.3. This review interface was moved from the end of the review interface listing because it is a HQMB review and should be listed for consistency with the other reviews performed by the HQMB.
39.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Sections 12.1 through 12.5.

Item	Source	Description
40.	**Integrated Impact # 1105,** and Editorial	Revised the citation of NUREG-0694 to NUREG-0737 in relation to TMI Action Plan item II.B.2. NUREG-0737 was issued after NUREG-0694 and contains a clarification for II.B.2 different from that of NUREG-0694. Deleted the phrase "to take corrective actions" as it is redundant. The parenthetical reference to CPs and OLs was also deleted as this review interface is applicable to a broader range of plant types than just CPs and OLs.
41.	SRP-UDP Format Item, Editorial and Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP section 16.0. In addition, editorial changes were made to reflect the fact that the Quality Assurance review interface was moved to the review interfaces performed by HQMB.
42.	SRP-UDP Format Item	The concluding statement of the Review Interfaces was modified to be consistent with the SRP-UDP format.
43.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP Section.
44.	Editorial.	Added the acronym SSCs for the phase, "Structures Systems and Components" as is consistent with the remainder of the SRP section.
45.	SRP-UDP Format, Editorial.	Removed the discussion on Regulatory Guide 1.29 as it is already addressed in the specific criteria section, therefore including this information here is redundant.
46.	Editorial.	Substituted the acronym SSCs for the phrase Structures Systems and Components as is consistent with the remainder of the section.
47.	SRP-UDP Format Item, Editorial and Resolution of B-3.	This is an editorial revision to associate anticipated operational occurrences with the discussion on not exceeding reactor coolant pressure boundary design conditions. This editorial revision is consistent with the wording of the General Design Criteria.
48.	**Integrated Impact #600**	The acceptance criteria for 10 CFR 50.46 was revised to clarify the criteria for acceptable ECCS evaluation models. 10 CFR 50.46 and Appendix K were revised on September 16, 1988 to permit the use of an acceptable evaluation model in lieu of Appendix K. The acceptance criteria was revised to be more flexible and to allow the use of an evaluation model (best estimate or realistic) in accordance with 10 CFR 50.46 or alternatively a model in conformance with Appendix K. The acceptance criteria was revised so that it does not focus solely on Appendix K.

Item	Source	Description
49.	**Integrated Impact # 596**	Relocated applicable TMI item from specific criteria to general acceptance criteria and revised the Acceptance Criteria to include a citation of 10 CFR 50.34(f)(1)(vii) in connection with the citation of II.K.3.18 of NUREG-0737. This issue covers modifications to the ADS logic to eliminate the need for manual actuation to assure adequate core cooling.
50.	**Integrated Impact # 1093**	Relocated applicable TMI items from specific criteria to general acceptance criteria and revised the Acceptance Criteria to include a citation of 10 CFR 50.34(f)(1)(viii) in connection with the citation of II.K.3.21 of NUREG-0737. A description of this issue, which covers designing BWR core spray and low pressure coolant injection systems to ensure that the systems will automatically restart on loss of water level, was revised to eliminate design-specific terminology and to more accurately reflect the requirements.
51.	**Integrated Impact # 597**	Revised the Acceptance Criteria to include 10 CFR 50.34(f)(1)(x) and II.K.3.28 of NUREG-0737. This issue is directed at ensuring the ADS equipment and instrumentation will be capable of performing their functions during and following an accident while taking no credit for non-safety-related equipment or instrumentation.
52.	**Integrated Impact # 1086**	Revised the Acceptance Criteria to include 10 CFR 50.34(f)(1)(xi) and II.K.3.45 of NUREG-0737. This issue relates to evaluating alternate methods of depressurization rather than full actuation of the ADS depressurization system.
53.	**Integrated Impact # 1017**	10 CFR 50.34(f)(2)(xxvi) and Item III.D.1.1 of NUREG-0737 were added to the Acceptance Criteria (III.D.1.1 was formerly addressed in the specific criteria section). This criteria establishes the provisions for leakage detection and control in the design of those systems outside of containment that contain or may contain radioactive materials following an accident.
54.	SRP-UDP Format Item, Editorial.	Listing of the items contained in the specific criteria is unnecessarily redundant and was removed consistent with the SRP-UDP format.
55.	SRP-UDP Format Item, Subsection Numbering Format	Each individual area of the specific acceptance criteria was numbered in accordance with the SRP-UDP format.
56.	SRP-UDP Format Item, Editorial.	Added "of 10 CFR 50.46" and deleted the reference citation.

Item	Source	Description
57.	**Integrated Impact # 600**	A discussion on the guidance of Regulatory Guide 1.157, "Best-Estimate Calculations of Emergency Core Cooling System Performance" was added to the specific criteria section of the Acceptance Criteria. Regulatory Guide 1.157 was issued to describe methods acceptable to the NRC staff for meeting the requirements for a realistic or best-estimate evaluation models for ECCS performance. Also included is a sentence on the alternative use of Appendix K as is consistent with the requirements of 10 CFR 50.46. The specific acceptance criteria section is the most appropriate section for discussing Regulatory Guides and is consistent with the format of this SRP section.
58.	**Integrated Impact # 600**; Editorial Changes	This is an editorial change to complete the listing of ECCS evaluation model related review areas that are completed under this SRP Section. The additional items listed come directly from and are consistent with the existing Review Procedures.
59.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for the GDCs a parenthetical reference is not required.
60.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for the GDCs a parenthetical reference is not required.
61.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for the GDCs a parenthetical reference is not required.
62.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for the GDCs a parenthetical reference is not required.
63.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for the GDCs a parenthetical reference is not required.
64.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for Regulatory Guides in the Acceptance Criteria (specific criteria) a parenthetical reference is not required.
65.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for Regulatory Guides in the Acceptance Criteria (specific criteria) a parenthetical reference is not required.
66.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for the GDCs a parenthetical reference is not required.

Item	Source	Description
67.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for the GDCs a parenthetical reference is not required.
68.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for Regulatory Guides in the Acceptance Criteria (specific criteria) a parenthetical reference is not required.
69.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for the GDCs a parenthetical reference is not required.
70.	SRP-UDP Format Item, Editorial	TMI Task Action Plan item II.K.3(15) and it associated discussion was moved up to replace the introductory sentence for TMI Action Plan Items as it was the only remaining item from the original list. This is only an editorial change to an existing criteria, no other changes were made.
71.	**Integrated Impact # 593.**	Added a specific criteria to the Acceptance Criteria section addressing the requirements and guidance for evolutionary BWR applicants regarding ECCS outage times and reports on unavailability.
72.	**Integrated Impact # 1103**	The citation of TMI Action Plan item II.B.8 has been deleted. The deleted text references a proposed rulemaking on degraded core accidents which has been abandoned.
73.	**Integrated Impact # 1017**	Deleted the specific criteria reference to III.D.1.1 this TMI Task Action Plan item is now addressed in the Acceptance Criteria section with 10 CFR 50.34(f)(2)(xxvi).
74.	**Integrated Impact # 593**	Deleted current citation of TMI Action Plan item II.E.2.1 from the Acceptance Criteria. As indicated in NUREG-0933 this item was subsumed by NUREG-0737 TMI Action Plan Item II.K.3.17. As documented in Generic Letter 83-36 TMI Action Plan item II.3.17 was resolved with no response required from licensees.
75.	**Integrated Impact # 1067**	Removed the citation of TMI Task Action Plan item II.K.3.10 from the Acceptance Criteria (specific criteria). This item was developed in response to a Westinghouse design specific proposal on interlocks for the reactor trip on turbine trip. This TMI action plan item is addressed in the reviews of SRP section 7.1 related to the reactor trip system and is not directly applicable to the ECCS reviews of SRP Section 6.3.
76.	SRP-UDP Format Item, Editorial	Task Action Plan Item II.K.3(15) was moved up in the list of Acceptance Criteria (specific criteria).

Item	Source	Description
77.	**Integrated Impact # 596**	Deleted the specific criteria reference to II.K.3.18. This TMI Task Action Plan item is now addressed in the Acceptance Criteria section with 10 CFR 50.34(f)(1)(vii). Also, the specific criteria discussion regarding ECCS outages for all plants was not consistent with the NUREG-0737 and 10 CFR 50.34(f) requirements.
78.	**Integrated Impact # 1093**	Deleted the specific criteria reference to II.K.3.21. This TMI Task Action Plan item is now addressed in the Acceptance Criteria section with 10 CFR 50.34(f)(1)(viii).
79.	**Integrated Impact # 1122**	The citation of II.K.3.39 was removed from the Acceptance Criteria (specific criteria). II.K.3.39 was not identified in NUREG-0660 as an action plan item. This item was not approved for implementation in NUREG-0737 and did not appear in NUREG-0718 as an item applicable to construction permit holders.
80.	SRP-UDP format item, adding Technical Rationale.	Technical rationale were developed and added for the following Acceptance Criteria: GDC 2, 4, 5, 17, 27, 35, 36, 37, and 10 CFR 50.46.
81.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP Section.
82.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP Section.
83.	SRP-UDP Format Item, Implement 10 CFR 52 Related Changes.	Added "design certification" to the list of appropriate reviews consistent with the SRP-UDP format and inclusion of appropriate design certification reviews.
84.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for Regulatory Guides in the Review Procedures a parenthetical reference is not required.
85.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for proper seismic category and safety class designations (SRP Sections 3.7.1 and 3.2.2).
86.	SRP-UDP Format Item, Update PRB names.	Removed PRB name as there is no other PRB or secondary reviewer mentioned in this review and it is understood by its presence in this SRP Section that this review is the responsibility of the SRXB.
87.	SRP-UDP Format Item, Update PRB names.	Removed PRB name as there is no other PRB or secondary reviewer mentioned in this review and it is understood by its presence in this SRP Section that this review is the responsibility of the SRXB.
88.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP section.

Item	Source	Description
89.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP sections 9.2.1, 9.2.2, 9.2.5, and 9.2.6.
90.	SRP-UDP Format Item, Editorial.	Deleted parenthetical reference as this Branch Technical Position is attached to this SRP Section and there is no need for a parenthetical reference. Added "Branch Technical Position" so the referenced title is consistent with the title of the Branch Technical Position.
91.	Editorial and **Integrated Impacts #s 595, 596, 597, and 1086**	Rewrote the introductory sentence covering the review of the ADS systems to allow for incorporation of the additional reviews necessary to verify compliance with the prescriptive requirements of the revised Acceptance Criteria. Substituted the acronym ADS for the complete system name as this acronym was defined previously in the section.
92.	SRP-UDP Formatting Change, Editorial	Step 10 has been revised to list reviews applicable to the BWR ADS. The original discussion on consideration of single failure has been expanded consistent with the existing Acceptance Criteria of GDC 17 and 35.
93.	**Integrated Impact # 596**	Added a Review Procedure to address the acceptance criteria contained in NUREG-0737 item II.K.3.18 and under 10 CFR 50.34(f)(1)(vii) regarding elimination of the need for manual actuation of the ADS to assure adequate core cooling.
94.	**Integrated Impact # 597**	Added a Review Procedure to address the acceptance criteria contained in NUREG-0737 item II.K.3.28 and under 10 CFR 50.34(f)(1)(x) regarding the capability of the ADS system to perform its functions under accident situations while taking no credit for non-safety-related equipment and accounting for normal air (or nitrogen) leakage through the valves. A review discussion on the interface with SRP Section 9.3.1 was also added to cover review of the supporting pneumatic supply system for ADS.
95.	**Integrated Impact # 1086**	Added a Review Procedure to address the acceptance criteria contained in NUREG-0737 item II.K.3.45 and under 10 CFR 50.34(f)(1)(xi) regarding evaluation of depressurization modes, other than full actuation of the ADS, that would reduce the possibility of exceeding vessel integrity limits during rapid cooldown.
96.	SRP-UDP Format Item, Editorial.	For consistency in style among the Review Procedures this sentence was revised to read like a design review rather than a verification of modifications to correct an existing design. The overall intent of the Review Procedure has not been changed.

Item	Source	Description
97.	SRP-UDP Format Item, Editorial.	Replaced "uses" with "use" to correct grammar error.
98.	PRB Comment	Added reference to NUREG-0927 in response to PRB comment, NRC Memo Li to Lyons dated November 1, 1995.
99.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for the GDCs a parenthetical reference is not required.
100.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP section.
101.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for the review of the electrical and instrumentation and controls aspects of the ECCS system.
102.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP section.
103.	Editorial	Revised the sentence for clarity.
104.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for this SRP section.
105.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for Regulatory Guides a parenthetical reference is not required.
106.	SRP-UDP Format Item, Editorial.	Replaced "of" with "for" to be consistent with the standard technical specifications.
107.	**Integrated Impact # 602**	Added an introductory sentence to address the ECCS aspects of the reviews covering periodic inservice inspection, pressure and functional testing.
108.	**Integrated Impact # 602**	Added a Review Procedure discussion in regard to the ECCS design having provisions to permit appropriate periodic inspections and pressure testing. This addition completes the original Review Procedure by making the review consistent with the Acceptance Criteria for GDC 36 and 37. Prior to this addition the Review Procedure addressing GDC 36 and 37 was not complete.
109.	**Integrated Impact # 602.**	Added steps 24.b, c, and d to address the ECCS design specific reviews covering the capability of an applicant to satisfy the inservice inspection and testing positions and requirements found in SECY 90-016, SECY 93-087 and their associated SRMs.
110.	SRP-UDP Format Item, Editorial.	Removed the PRB acronym as the SRXB, which is the PRB for this section, is implied.

Item	Source	Description
111.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP section 14.2.
112.	SRP-UDP Format Item, Editorial.	In accordance with the SRP-UDP formatting requirements when citing references for Regulatory Guides a parenthetical reference is not required.
113.	SRP-UDP Format Item, Editorial.	Removed the PRB acronym as the SRXB, which is the PRB for this section, is implied.
114.	**Integrated Impact # 1103**	The citation of TMI Action Plan item II.B.8 has been deleted. The deleted text references a proposed rulemaking on degraded core accidents which has been abandoned.
115.	**Integrated Impact # 1017**	Addressed the review of leakage detection and control in the design of systems outside containment that contain (or might contain) radioactive material following an accident.
116.	**Integrated Impact # 593**	Deleted current citation of TMI Action Plan item II.E.2.1 from the Review Procedures. As indicated in NUREG-0933 this item was subsumed by NUREG-0737 TMI Action Plan item II.K.3.17. As documented in Generic Letter 83-36 TMI Action Plan item II.K.3.17 was resolved with no response required from licensees.
117.	**Integrated Impact # 1067**	Removed the citation of TMI Task Action Plan item II.K.3.10 from the Review Procedures. This item was developed in response to a Westinghouse design specific proposal on interlocks for the reactor trip on turbine trip. This TMI action plan item is addressed in the reviews of SRP section 7.1 related to the reactor trip system and is not directly applicable to the ECCS reviews of SRP Section 6.3.
118.	**Integrated Impact # 599**	The Review Procedure associated with TMI Task Action Plan item II.K.3.15 regarding break detection logic and spurious isolation of the HPCI and RCIC systems was modified to incorporate the staff guidance contained in Generic Letter 83-02.
119.	**Integrated Impact # 596**	Deleted the reference to II.K.3.18 contained in Review Procedure step 26. This TMI Task Action Plan item is now addressed under Review Procedure step 10 addressing the BWR ADS systems.
120.	**Integrated Impact # 1093**	Revised step 26 to address the review of BWR LPCI system logic so that these systems will restart, if required, to assure adequate core cooling.

Item	Source	Description
121.	**Integrated Impact # 1122**	The citation of II.K.3.39 was removed from step 26 of the Review Procedures. II.K.3.39 was not identified in NUREG-0660 as an action plan item. This item was not approved for implementation in NUREG-0737 and did not appear in NUREG-0718 as an item applicable to construction permit holders.
122.	**Integrated Impact # 593**	Added a Review Procedure applicable to evolutionary BWRs addressing cumulative outage times, and reporting requirements for ECCS unavailability. This review procedure is consistent with the reviews and guidance documented in the ABWR FSER on this issue.
123.	**Integrated Impact # 603.**	Added a new review procedure to address the reviews necessary to verify proper design of the miniflow systems required to ensure ECCS pump protection. The guidance provided is consistent with the NRC staff positions as described in Generic Letter 89-04 and NRC Bulletins 79-24, 80-18, 86-03, and 88-04.
124.	**Integrated Impact # 606**	Added a Review Procedure to address the NRC staff guidance concerning ECCS capability to provide reactor coolant system inventory additions during reduced inventory operations. This Review Procedure is consistent with the guidance contained in Generic Letter 88-17 which details a set of actions to be implemented by licensees prior to reduced inventory operations.
125.	**Integrated Impact # 601.**	A new review procedure was added to address the NRC positions and guidance contained in NRC Bulletin 88-08. The reviewer should verify, consistent with the guidance of NRC Bulletin 88-08, that the ECCS system will be designed in a manner that prevents the possibility of thermal stratification and oscillations.
126.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard paragraph to address application of Review Procedures in design certification reviews.
127.	SRP-UDP Format Item, Editorial.	Replaced the "his" with "that the" to make this sentence gender neutral.
128.	SRP-UDP Format Item, Update PRB names.	Changed PRB name to reflect latest responsibility assignments for SRP Section 15.6.5.
129.	**Integrated Impact # 596**	Added 10 CFR 50.34(f)(1)(vii) to the list of Acceptance Criteria in the Evaluation Findings to address TMI Action Plan Item II.K.3.18.
130.	**Integrated Impact # 1093**	Added 10 CFR 50.34(f)(1)(viii) to the list of Acceptance Criteria in the Evaluation Findings to address TMI Action Plan Item II.K.3.21.

Item	Source	Description
131.	**Integrated Impact # 597**	Added 10 CFR 50.34(f)(1)(x) to the list of Acceptance Criteria in the Evaluation Findings to address TMI Action Plan Item II.K.3.28.
132.	**Integrated Impact # 1086**	Added 10 CFR 50.34(f)(1)(xi) to the list of Acceptance Criteria in the Evaluation Findings to address TMI Action Plan Item II.K.3.45.
133.	**Integrated Impact # 1017**	Added 10 CFR 50.34(f)(2)(xxvi) to the list of Acceptance Criteria in the Evaluation Findings to address TMI Action Plan Item III.D.1.1.
134.	**Integrated Impact # 600**	Added 10 CFR 50.46 to the list of acceptance criteria in the introductory portion of the Evaluation Findings.
135.	SRP-UDP Format Item, Editorial.	Defined the acronym SSCs for the phrase, "Structures Systems and Components" for the first occurrence in the Evaluation Findings as is consistent with the remainder of the section.
136.	**Integrated Impact # 600**	Evaluation Findings step number IV.(9) was revised to specify the requirements of the amended 10 CFR 50.46. 10 CFR 50.46 now allows for use of an acceptable evaluation model, the guidance of Regulatory Guide 1.157 being an acceptable method for best estimate models, or alternatively Appendix K to 10 CFR Part 50 as the acceptance criteria for the ECCS being designed so that its cooling performance is in accordance with an acceptable evaluation model. This change is consistent with the modifications to the Acceptance Criteria and the Review Procedures.
137.	**Integrated Impact # 596**	Added an Evaluation Finding to address the requirements of 10 CFR 50.34(f)(1)(vii) and the requirements of item II.K.3.18 of NUREG-0737 regarding eliminating the need for manual actuation of the BWR ADS system to assure adequate core cooling.
138.	**Integrated Impact # 1093**	Added an Evaluation Finding to address the requirements of 10 CFR 50.34(f)(1)(viii) and the requirements of item II.K.3.21 of NUREG-0737 regarding studying the design of BWR core spray and low pressure coolant injection systems to ensure that the systems will automatically restart on loss of water level, after having been manually stopped, if an initiation signal is still present.
139.	**Integrated Impact # 597**	Added an Evaluation Finding to address the requirements of 10 CFR 50.34(f)(1)(x) and the requirements of item II.K.3.28 of NUREG-0737 regarding the capability of the BWR ADS equipment and instrumentation during and following an accident situation.

Item	Source	Description
140.	**Integrated Impact # 1086**	Added an Evaluation Finding to address the requirements of 10 CFR 50.34(f)(1)(xi) and the requirements of item II.K.3.45 of NUREG-0737 in regard to providing an evaluation of depressurization methods, other than full actuation of the ADS, that would reduce the possibility of exceeding vessel integrity limits during rapid cooldown for BWRs.
141.	**Integrated Impact # 1017**	Added an Evaluation Finding to address the requirements of 10 CFR 50.34(f)(2)(xxvi) and the requirements of item III.D.1.1 of NUREG-0737 regarding leakage detection and control for the ECCS systems located outside of containment that contain or may contain radioactive material.
142.	SRP-UDP Format Item, Editorial	TMI Task Action Plan item II.K.3(15) and its associated discussion was moved up to complete this evaluation finding sentence as it was the only remaining item in the original list. This is only an editorial change to an existing finding, no other changes were made.
143.	**Integrated Impact # 1103**	The citation of TMI Action Plan item II.B.8 has been deleted. The deleted text references a proposed rulemaking on degraded core accidents which has been abandoned.
144.	**Integrated Impact # 1017**	Deleted the reference to III.D.1.1 of NUREG-0737 listed in the TMI Action Plan items of the Evaluation Findings. This TMI Action Plan Item is now address by Evaluation Findings step (14) and it is not necessary to repeat a reference to it here.
145.	**Integrated Impact # 593**	Deleted current citation of TMI Action Plan item II.E.2.1 from the Evaluation Findings. As indicated in NUREG-0933 this item was subsumed by NUREG-0737 TMI Action Plan item II.K.3.17. As documented in Generic Letter 83-36 TMI Action Plan item II.K.3.17 was resolved with no response required from licensees.
146.	**Integrated Impact # 1067**	Removed the citation of TMI Task Action Plan item II.K.3.10 from the Evaluation Findings. This item was developed in response to a Westinghouse design specific proposal on interlocks for the reactor trip on turbine trip. This TMI action plan item is addressed in the reviews of SRP section 7.1 related to the reactor trip system and is not directly applicable to the ECCS reviews of SRP Section 6.3.
147.	SRP-UDP Format Item, Editorial	Task Action Plan Item II.K.3(15) was moved up from the list of TMI Action Plan items and replaced with the final sentence in the evaluation findings section.

Item	Source	Description
148.	**Integrated Impact # 596**	Deleted the reference to II.K.3.18 of NUREG-0737 listed in the TMI Action Plan items of the Evaluation Findings. This TMI Action Plan Item is now address by Evaluation Findings step (10) and it is not necessary to repeat a reference to it here.
149.	**Integrated Impact # 1093**	Deleted the reference to II.K.3.21 of NUREG-0737 listed in the TMI Action Plan items of the Evaluation Findings. This TMI Action Plan Item is now address by Evaluation Findings step (11) and it is not necessary to repeat a reference to it here.
150.	**Integrated Impact # 1122**	The citation of II.K.3.39 was removed from the list of TMI Task Action Plan items in the Evaluation Findings. II.K.3.39 was not identified in NUREG-0660 as an action plan item. This item was not approved for implementation in NUREG-0737 and did not appear in NUREG-0718 as an item applicable to construction permit holders.
151.	SRP-UDP Format Item, Implement 10 CFR 52 Related Changes	To address design certification reviews a new paragraph was added to the end of the Evaluation Findings. This paragraph addresses design certification specific items including ITAAC, DAC, site interface requirements, and combined license action items relevant to SRP 6.3.
152.	SRP-UDP Guidance, Implementation of 10 CFR 52	Added standard sentence to address application of the SRP section to reviews of applications filed under 10 CFR Part 52, as well as Part 50.
153.	SRP-UDP Guidance	Added standard paragraph to indicate applicability of this section to reviews of future applications.
154.	SRP-UDP Format Item, Editorial.	Added the word "regulations" to the list of documents containing implementation schedules in order to address implementation schedule for regulatory requirements.
155.	SRP-UDP Format Item, Update Implementation Section	The implementation statements that are specific to a particular revision must be modified to reflect the associated revision date of the item. In this case the date specific item was related to water hammer guidance and the incorporating revision to the SRP occurred in April 1984 (the last revision date for 6.3).

Item	Source	Description
156.	SRP-UDP Format Item, Update Implementation Section	The implementation statements that are specific to a particular revision must be modified to reflect the associated revision date of the item. In this case the date specific item was related to water hammer guidance and the incorporating revision to the SRP occurred in April 1984 (the last revision date for 6.3). However, as indicated CP applicants were required to comply with the provisions of the April 1984 revision so no restriction was added other than to indicate as of April 1984.
157.	SRP-UDP Format Item, Update Implementation Section	The implementation statements that are specific to a particular revision must be modified to reflect the associated revision date of the item. In this case the date specific item was related to water hammer guidance and the incorporating revision to the SRP occurred in April 1984 (the last revision date for 6.3).
158.	SRP-UDP Format Item, Editorial.	The references have been reordered and renumbered as necessary to incorporate new references and for consistency with the order contained in the SRP-UDP format guidelines.
159.	**Integrated Impacts # 596, 597, 1017, 1086, and 1093**	Added a reference to 10 CFR 50.34(f), “Additional TMI-Related Requirements” to address the citation of the TMI items under this section of the CFR.
160.	**Integrated Impact # 600,** Reference Verification.	Revised the first reference addressing 10 CFR 50.46 to delete the information on the old amendment issued in the federal register. Consistent with the SRP-UDP format details on the issue date in the federal register are not included in the references to the code of federal regulations. The title of 10 CFR 50.46 was also revised to make it consistent with the current title. 10 CFR 50.46, Appendix K was removed from the reference for 10 CFR 50.46 and added as a separate reference.
161.	**Integrated Impact # 605.**	Added a new reference covering 10 CFR 50.63, "Loss of all Alternating Current Power."
162.	SRP-UDP Format Item, Reference Verification and disposition of PI-21754.	To ensure proper sequencing of the references, the reference to GDC 4 was moved up. The title to GDC 4 was also revised to be consistent with the current title found in Appendix A to 10 CFR 50.
163.	SRP-UDP Format Item, Reformat References	Separated 10 CFR 50, Appendix K from the reference for 10 CFR 50.46.
164.	SRP-UDP Format Item, Reference Verification	Deleted the reference to the revision number for Regulatory Guide 1.29, revision 1 has been superseded by revision 3.
165.	SRP-UDP Format Item, Reference Verification	Corrected the title of Regulatory Guide 1.47 “Bypass” should be “Bypassed.”

Item	Source	Description
166.	SRP-UDP Format Item, Reference Verification	Corrected the title of Regulatory Guide 1.52.
167.	SRP-UDP Format Item, Reference Verification	Updated the title for Regulatory Guide 1.68, “Initial Test Programs for Water Cooled Nuclear Power Plants.”
168.	**Integrated Impact # 605**	Added a reference to Regulatory Guide 1.155, “Station Blackout” to address staff guidance and positions on the station blackout event.
169.	**Integrated Impact # 600**	Added a new reference for Regulatory Guide 1.157, "Best-Estimate Calculations of Emergency Core Cooling System Performance."
170.	SRP-UDP Format Item, Editorial.	Revised the clarification at the end of this reference to indicate that the Branch Technical Position RSB 6-1 is attached to this SRP Section.
171.	**Integrated Impact # 602**	Added a reference to SECY 90-016 to support the Review Procedure added to address ECCS design configurations necessary to support inservice and functional testing.
172.	**Integrated Impact # 602**	Added a reference to the SRM for SECY 90-016 to support the Review Procedure added to address ECCS design configurations necessary to support inservice and functional testing.
173.	**Integrated Impact # 602**	Added a reference to SECY 93-087 to support the Review Procedures added to address the evolutionary BWR ADS general criteria and ECCS design configurations necessary to support inservice and functional testing.
174.	**Integrated Impact # 602**	Added a reference to the SRM for SECY 93-087 to support the Review Procedure added to address the evolutionary BWR ADS general criteria and ECCS design configurations necessary to support inservice and functional testing.
175.	**Integrated Impact # 599**	Added a reference to Generic Letter 83-02 which provides staff guidance on the minimum and maximum expected response times for the pipe-break-detection circuitry. This function ensures that pressure spikes resulting from HPCI and RCIC system initiation will not cause inadvertent system isolation.
176.	**Integrated Impact # 606**	Added a reference to Generic Letter 88-17, “Loss of Decay Heat Removal” that contains guidance and staff positions concerning ECCS capability to provide reactor coolant system inventory additions during reduced inventory operations.

Item	Source	Description
177.	**Integrated Impact # 603.**	Added a reference covering Generic Letter 89-04, "Guidance on Developing Acceptable Inservice Testing Programs." This Generic Letter contains guidance on the design of the miniflow systems for the ECCS pumps.
178.	**Integrated Impact # 603.**	Added a reference to NRC Bulletin 79-24 addressing a frozen miniflow line.
179.	**Integrated Impact # 603**	Added a reference for NRC Bulletin 80-18. This Bulletin contains guidance on miniflow design considerations including maintaining miniflow to ECCS pumps under safety injection initiation conditions.
180.	**Integrated Impact # 603**	Added a reference for NRC Bulletin 86-03. This Bulletin contains guidance on miniflow design considerations including a design deficiency that created a single failure vulnerability in the minimum flow recirculation line of ECCS pumps.
181.	**Integrated Impact # 603**	Added a reference for NRC Bulletin 88-04, "Potential Safety-Related Pump Loss." This Bulletin contains guidance on miniflow design considerations including parallel pump operation under miniflow conditions.
182.	**Integrated Impact # 601**	Added a reference to NRC Bulletin 88-08 to provide additional information on the review of ECCS systems in regard to thermal stratification of unisolable piping connected to the reactor coolant system.
183.	PRB Comment	Added reference to NUREG-0927 in response to PRB comment, NRC Memo Li to Lyons dated November 1, 1995.
184.	**Integrated Impact # 661,** SRP-UDP Format Item, Reference Verification.	Added a reference item covering American National Standard, "Single Failure Criteria for PWR Fluid Systems," ANSI N658 (ANS-51.7). This standard is referenced in BTP RSB 6-1.
185.	SRP-UDP Format Item, Editorial.	Added the responsible PRB name and acronym to the title of this Branch Technical Position.
186.	**Integrated Impact # 661,** SRP-UDP Format Item, Reference Verification and Editorial Changes.	ANSI N658 was issued in 1976, therefore, use of the phrase "A recent draft of" is inappropriate and was removed. A review of ANSI N658 identified minor editorial differences between the standard definitions and the definitions contained the SRP. These minor editorial differences were corrected to make the SRP agree verbatim with the ANS standard.
187.	SRP-UDP Format Item, Editorial.	In this type of usage allowing for either plural or singular, "sumps" should be "sump".

Item	Source	Description
188.	SRP-UDP Format Item, Update Implementation Section.	For clarity the implementation section was updated so its format and order is consistent with the implementation sections found in the SRP. All of the applicable guidance was retained and included in these statements. However, consistent with SRP-UDP guidance the implementation statements specific to a particular revision were modified to reflect the associated revision date of the item.
189.	SRP-UDP Format Item, Update Implementation Section	The implementation statements that are specific to a particular revision must be modified to reflect the associated revision date of the item. In this case the date specific item was related to the guidance of BTP RSB 6-1. For this item, the incorporating revision date was maintained as the SER publishing date of April 16, 1975 as specified in the original implementation statement.
190.	SRP-UDP Format Item, Update Implementation Section	The implementation statements that are specific to a particular revision must be modified to reflect the associated revision date of the item. In this case the date specific item was related to the guidance of BTP RSB 6-1 and the incorporating revision to the SRP occurred in July 1981 (the last revision date for BTP RSB 6-1).
191.	SRP-UDP Format Item, Update Implementation Section	The implementation statements that are specific to a particular revision must be modified to reflect the associated revision date of the item. In this case the date specific item was related to the guidance of BTP RSB 6-1 and the incorporating revision to the SRP occurred in July 1981 (the last revision date for BTP RSB 6-1).

Integrated Impact No.	Issue	SRP Subsections Affected
593	Revise the Acceptance Criteria and Review Procedures that address Task Action Plan item II.E.2.1. NUREG-0737 does not identify II.E.2.1 as an applicable item.	Acceptance Criteria (specific criteria) Review Procedures Evaluation Findings
594	This integrated impact will not be processed further. See integrated impacts 595, 596, 597, and 1086 for details on the changes related to this integrated impact.	None.
595	Develop Review Procedures to address the NRC staff positions and guidance on the automatic depressurization system (ADS) for ALWR plant designs.	Areas of Review (review interfaces)
596	Revise the Acceptance Criteria and Review Procedures to address TMI Task Action Plan item II.K.3.18 regarding elimination of manual actuation of the BWR ADS system.	Areas of Review Acceptance Criteria Review Procedures Evaluation Findings References
597	Add Acceptance Criteria and Review Procedures to address conformance of the ADS system design to the requirements contained in NUREG-0737 item II.K.3.28 and 10 CFR 50.34(f)(1)(x).	Areas of Review Acceptance Criteria Review Procedures Evaluation Findings References
598	See integrated impact # 1103 for details on the actions taken in regard to the issues addressed by this integrated impact.	None.
599	Revise the Review Procedures associated with TMI item II.K.3.15 regarding isolation of HPCI and RCIC for BWRs. In addition, incorporate the guidance contained in Generic Letter 83-02.	Review Procedures References
600	Incorporate the requirements regarding the use of realistic, or best-estimate, evaluation models for the ECCS in accordance with 10 CFR 50.46 and Regulatory Guide 1.157.	Areas of Review Acceptance Criteria Evaluation Findings References
601	Add a Review Procedure to ensure the ECCS system design has provisions to ensure that thermal stratification and thermal stresses, which may occur in the unisolable portions of piping connected to the RCS, are properly accounted for.	Areas of Review Review Procedures References
602	Add a Review Procedure to address the review of the ECCS systems capability to support additional inservice inspection and testing guidance and requirements.	Areas of Review (review interfaces) Review Procedures References

Integrated Impact No.	Issue	SRP Subsections Affected
603	Add Review Procedures to address the proper design of the miniflow systems required to ensure ECCS pump protection.	Review Procedures References
604	Add an Areas of Review (review interface) to address the concerns of Generic Issue 105 on ISLOCA. Proposed new SRP section 3.12 will address ISLOCA issues.	Areas of Review
605	Add Acceptance Criteria and Review Procedures to address the capability of the ECCS systems to provide injection and core cooling following a station blackout event.	Areas of Review (review interfaces) References
606	Add Review Procedures to address the ECCS capability to provide reactor coolant system inventory additions during reduced inventory operations.	Review Procedures References
661	The BTP cites ANSI N658 with no date specified. ANSI N658 is also specified as ANS 58.9. If appropriate specify the reaffirmed version of ANS 58.9.	BTP RSB 6-1
1001	See integrated impact # 593 for details on actions taken in regard to the issues described in this integrated impact.	None.
1017	Update the Acceptance Criteria and other subsections to reflect the requirement of 10 CFR 50.34(f)(2)(xxvi) and NUREG-0737 TMI Action Plant item III.D.1.1 related to leakage detection and control.	Acceptance Criteria Review Procedures Evaluation Findings References
1034	Revise the Areas of Review discussion associated with TMI Action Plan item I.C.6. regarding verification of correct performance of operating activities.	Areas of Review (review interfaces)
1064	This is a duplicate integrated impact and will not be processed further, see integrated impact # 596 for details on the changes necessary to address the issues described in this integrated impact.	None.
1067	Delete the existing citation of TMI Action Plan item II.K.3.10. This item should be reviewed under SRP Section 7.1 as it is primarily related to the reactor trip and turbine trip systems.	Acceptance Criteria Review Procedures Evaluation Findings
1072	This integrated impact will not be processed further due to development of a new SRP section addressing reactor coolant depressurization systems (see integrated impact # 1318).	None

Integrated Impact No.	Issue	SRP Subsections Affected
1086	Add TMI Action Plan item II.K.3.45 and 10 CFR 50.34(f)(1)(xi) regarding providing and evaluation of depressurization methods, other than full actuation of the ADS, that would reduce possibility of exceeding vessel integrity limits during rapid cooldown for BWRs.	Areas of Review Acceptance Criteria Review Procedures Evaluation Findings References
1089	This is a duplicate integrated impact that will not be processed further, see integrated impact # 597 for details on the changes necessary to address the issues identified in this integrated impact.	None.
1093	Add TMI Action Plan item II.K.3.21 in conjunction with 10 CFR 50.34(f)(1)(viii) with respect to studying the design of BWR core spray and low pressure coolant injection systems to ensure that the systems will automatically restart on a loss of water level, after having been manually stopped, if an initiation signal is still present.	Acceptance Criteria Review Procedures Evaluation Findings References
1103	Delete Acceptance Criteria and Review Procedures related to interim degraded core accident rulemaking.	Acceptance Criteria Review Procedures Evaluation Findings
1105	Add and revise review interfaces related to TMI Action Plan item II.B.2 and plant shielding for post-accident operation.	Areas of Review (review interfaces)
1107	Revise or delete the current citation of TMI Action Plan item II.K.1.10 regarding procedures for removing safety-related systems from service.	Areas of Review
1122	Revise the Acceptance Criteria and Review Procedures to modify the citation of TMI Action Plan items II.K.2.15 and II.K.3.39 related to the evaluation of the effects of slug flow on steam generator tubes for B&W plants.	Areas of Review Acceptance Criteria Review Procedures Evaluation Findings